

ENERGY-EFFICIENT LIGHTWEIGHT SOLUTIONS

Railway Technology

Improving space and energy efficiency is a key challenge for today's railway industry. Armacell's thermal and acoustic insulation products and sustainable foam cores optimise the weight-to-performance ratio. What's more, they increase passenger safety and comfort. Our innovative solutions are used in rail vehicles all over the world, where they ensure safe and smooth operation. **Get on track to a greener tomorrow.**

www.armacell.com



MEETING THE
HIGHEST
REQUIREMENTS



 **armacell**[®]
MAKING A DIFFERENCE AROUND THE WORLD

ABOUT ARMACELL

We are the inventors of flexible foams for equipment insulation and a leading provider of engineered foams. Our lightweight thermal, acoustic and mechanical solutions create sustainable value for our customers. Day in day out, our products significantly contribute to global energy efficiency and make a difference around the world. In meeting the challenges of megatrends, such as energy efficiency, lightweighting, the globalisation of food supplies and acoustic comfort, our product solutions stand out in terms of functionality and ease of installation.

3,000

employees worldwide representing 70 different nationalities

23

production facilities in 15 countries on 4 continents

300+

active patents in 50 patent families



// Passionate

Dedicated and professionally minded employees with an entrepreneurial spirit are our greatest asset. They share a common set of core values: customer experience, commitment, empowerment and accountability, integrity and sustainability.

Armacell.

Making a difference around the world.

SOLUTIONS ENABLING ENERGY SAVINGS.

CUSTOMER-CENTRIC



We create genuine value for our customers, appreciate them as partners, and are committed to developing solutions tailored to their requirements. The outcome is added value for our business partners and, most significantly, energy savings and a longer working life for their critical equipment.

INNOVATIVE

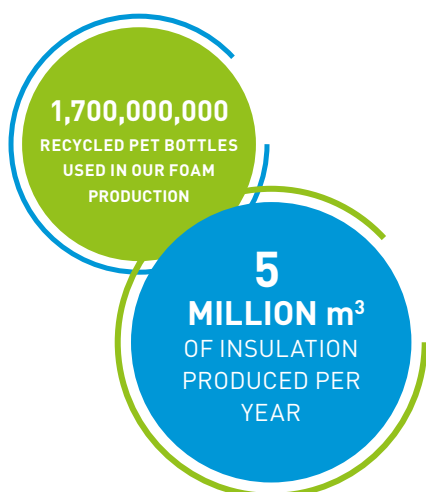


We innovate in new technologies and focus on products that deliver superior technical performance. With our ArmaFlex® Rail products we presented the first closed-cell insulation materials to meet the highest requirements of EN 45545-2. Our most recent product launches include ArmaPET® Shape, the first PET-based particle foam, and ArmaGel® Rail, the next-generation aerogel technology offering up to five times superior thermal performance compared to conventional insulation materials.

SUSTAINABLE



We dedicate our business activities to advancing and optimising energy efficiency for equipment and to closing the loop to achieve a more sustainable use of resources. Our ArmaFlex insulation saves 140 times more energy than is required for its production and prevents the emission of several million tonnes of CO₂ per year. Our ArmaPET product portfolio is based on 100 percent recycled PET bottles and is fully recyclable.



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OUR SOLUTIONS FOR THE RAILWAY INDUSTRY.

THERMAL INSULATION

The energy required for heating and air conditioning passenger rail vehicles can account for 30 to 40 percent of the total energy use. With Armacell's thermal insulation, rail operators can reduce costs and meet the growing demand for increased energy efficiency and an enhanced weight-to-performance ratio.

// ArmaFlex Rail 1 2 6 10

// ArmaGel Rail 1 2 3 5 9

// ArmaComp Smart 3 5 6

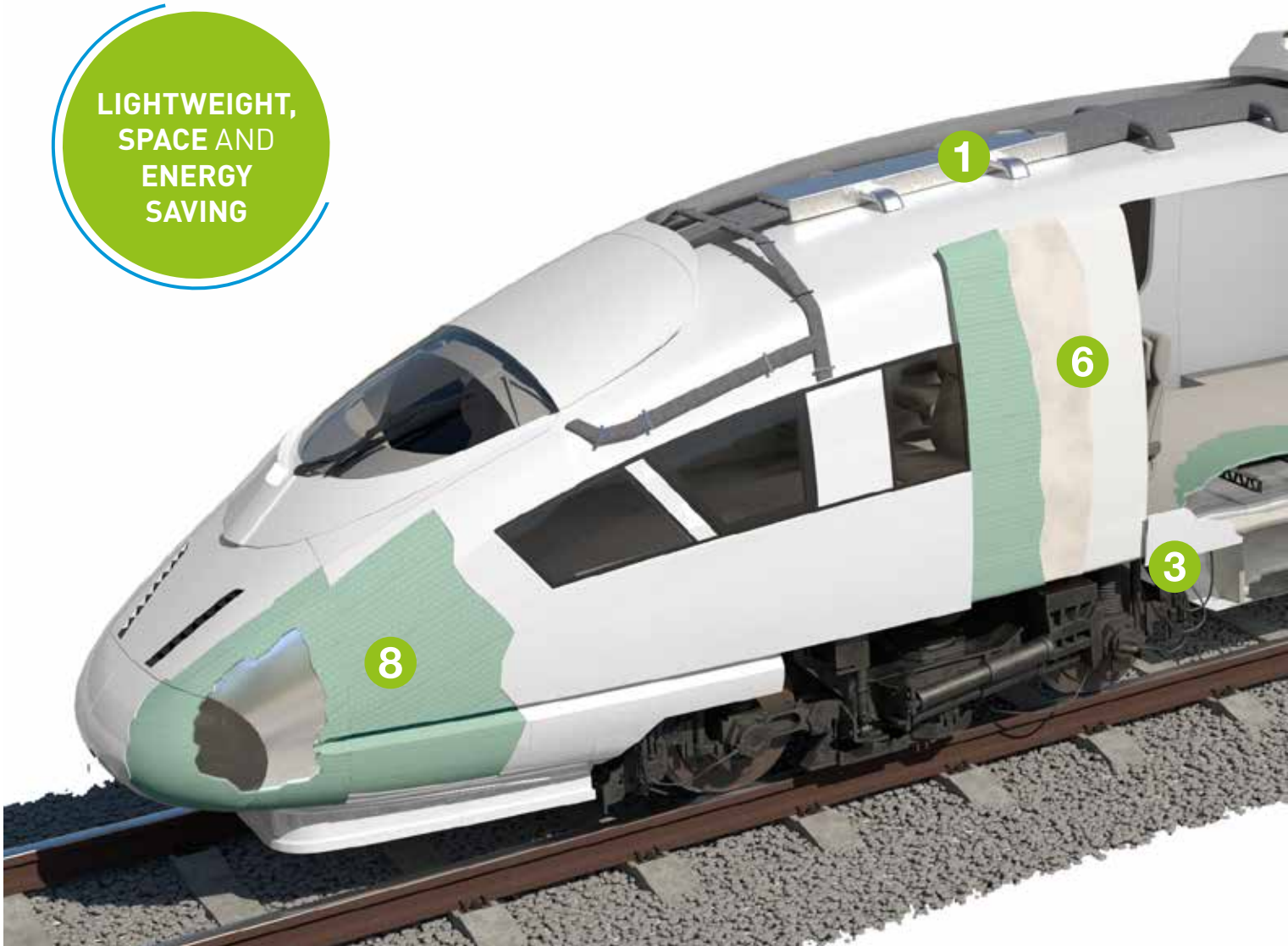
ACOUSTIC COMFORT

Optimising acoustic comfort is one of the most important factors in improving the overall customer experience and making railways more competitive with other transportation modes. Our ArmaComfort Rail products provide superior acoustic transmission reduction and ArmaComp Smart combines thermal and acoustic insulation in a super-lightweight solution.

// ArmaComfort Rail 2 3 5 6 7 9

// ArmaComp Smart 3 5 6

LIGHTWEIGHT,
SPACE AND
ENERGY
SAVING

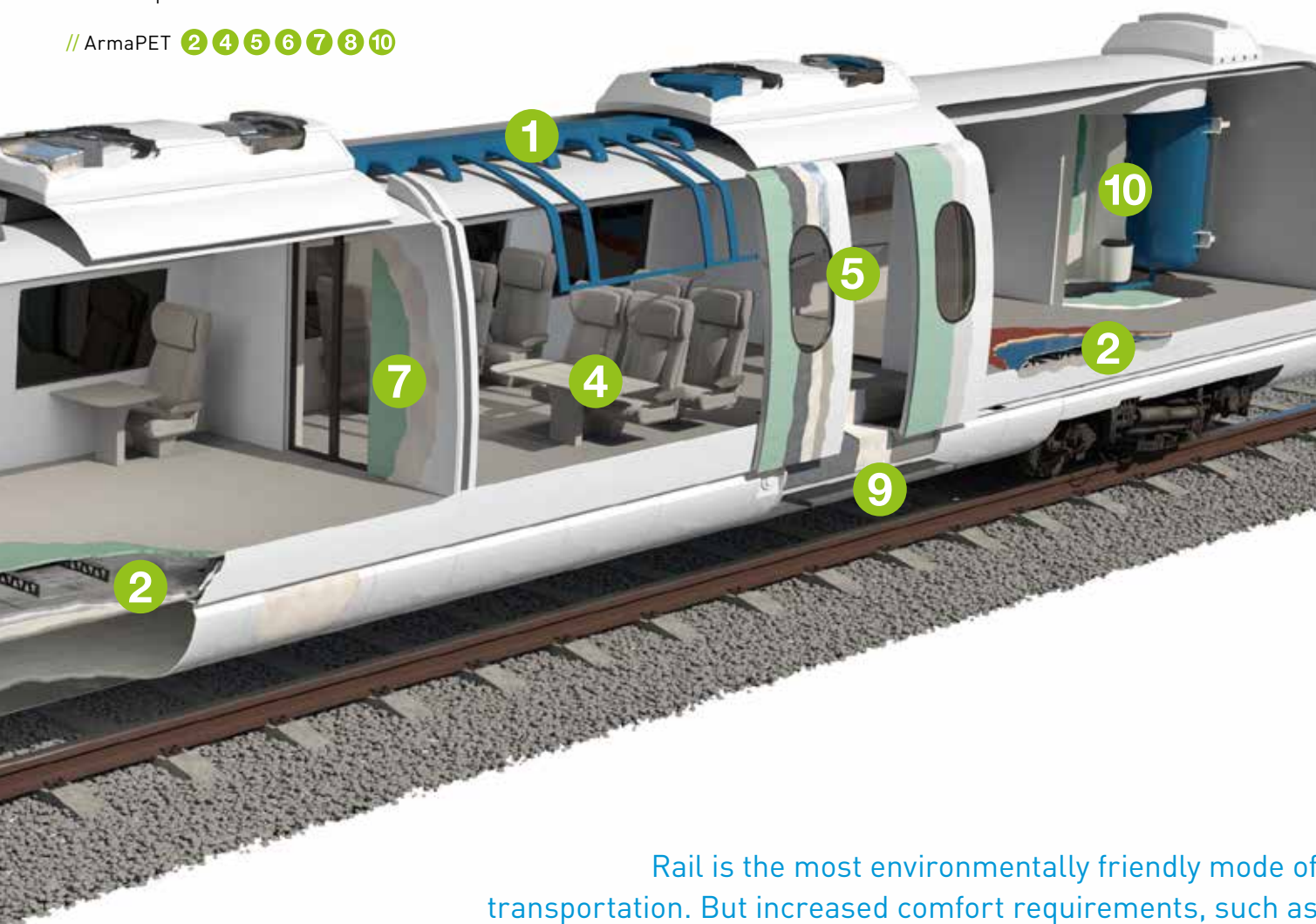




LIGHTWEIGHT STRUCTURES

The lighter the train, the more energy efficient and cost effective its operation. Their unique material and processing properties make our ArmaPET materials the ideal core solution for structural and interior elements in trains. Based on 100 percent recycled material and completely recyclable after their service life, our ArmaPET solutions contribute to a more sustainable and safe operation.

// ArmaPET 2 4 5 6 7 8 10



Rail is the most environmentally friendly mode of transportation. But increased comfort requirements, such as air conditioning, comfortable seats and tables, easily accessible lavatories and CET tanks have made trains heavier and more expensive to operate. To maintain the environmental advantage, energy efficiency has to be improved – without compromising passenger safety and comfort.

WHETHER NEW OR TRIED-OR-TESTED, ARMACELL TECHNOLOGIES CAN HELP TO MAKE TRAINS LIGHTER, MORE EFFICIENT AND MORE COMFORTABLE FOR PASSENGERS.

1 HVAC

Wherever energy is transported, some of the valuable resource is lost when equipment is poorly insulated or not insulated. Insulating HVAC equipment – the second largest energy consumer – with our dedicated ArmaFlex Rail or ArmaGel Rail solutions offers enormous energy-saving potential. They protect mechanical equipment against heat loss, support its long-term function and reduce operating costs.

// ArmaFlex Rail

// ArmaGel Rail



Our ArmaFlex Rail range includes halogen-free, Microban-protected and coated solutions. The high-performance ArmaGel Rail products offer ultimate energy efficiency without sacrificing limited space.



PROTECTION THAT LIVES ON
MICROBAN

Unprotected surface



Protected with Microban®



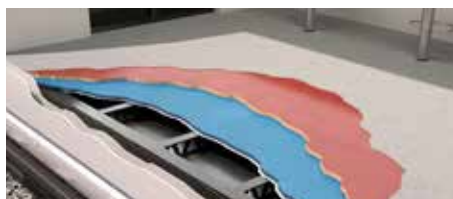
Armacell is the only manufacturer of flexible technical insulation materials to provide products with built-in anti-microbial protection: ArmaFlex Rail SD and ArmaFlex Rail SD-C are equipped with Microban®. These antimicrobial additives provide 'proactive' protection against harmful bacteria, mould and mildew.



**MORE
SAFETY
AND COMFORT
ON THE
TRACKS**



To prevent condensation in floor constructions our closed-cell ArmaFlex Rail forms a reliable vapour barrier and mitigates the risk of corrosion.



2 FLOOR

High strength, low weight and excellent fatigue and durability properties make ArmaPET Struct today's benchmark for a sustainable alternative to conventional materials in rail vehicle construction. ArmaGel Rail offers superior thermal insulation with ultra-thin thicknesses and ArmaComfort Rail effectively reduces sound transmission without compromising on space.

- // ArmaPET Struct
- // ArmaGel Rail
- // ArmaComfort Rail
- // ArmaFlex Rail



3 WHEEL AREA

Rolling noise increases with the train speed and is the most important noise source in high-speed trains. State-of-the-art insulation with ArmaComfort Rail ensures a marked reduction of airborne noise in rail vehicles.

- // ArmaComfort Rail
- // ArmaGel Rail
- // ArmaComp Smart

THE LIGHTER THE TRAIN, THE MORE ENERGY EFFICIENT AND COST EFFECTIVE ITS OPERATION. LIGHTWEIGHT CORE FOAMS AND INSULATION MATERIALS IMPROVE THERMAL AND ACOUSTIC COMFORT ON THE RAILS.

4 TABLES

In sandwich constructions our lightweight foam cores add stiffness and durability to the panel. They can be coated with a wide variety of materials, e.g. easy-to-clean skins. A solvent-resistant surface allows cleaning in line with the rail industry's high hygiene standards.

// ArmaPET Struct



5 DOORS

Our new ArmaGel Rail and ArmaComp Smart products prevent energy losses in rail applications without sacrificing space. ArmaComfort Rail efficiently minimises the noise level in trains.

// ArmaGel Rail

// ArmaComp Smart

// ArmaComfort Rail

// ArmaPET Struct



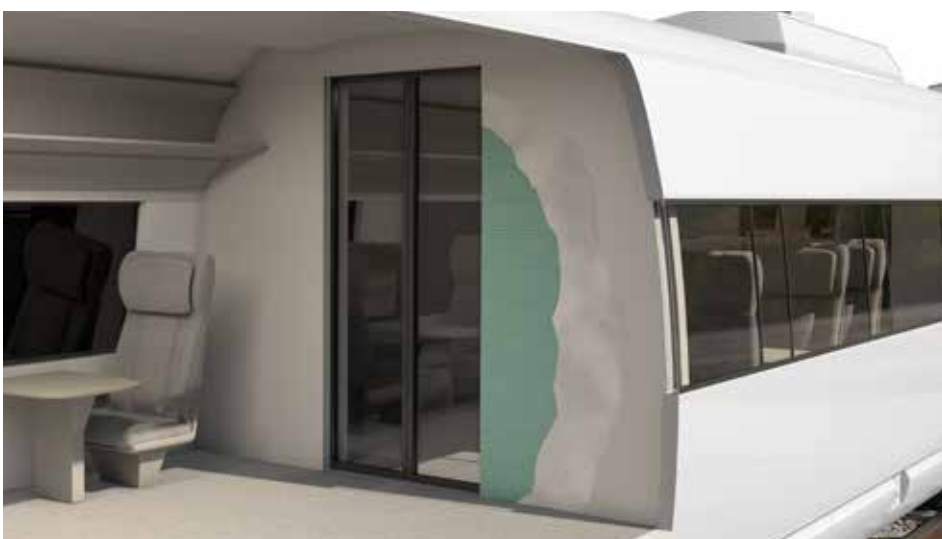
The combination of weight-saving potential, environmental benefits and excellent mechanical and fire properties make ArmaPET Struct the material of choice for railway composite structures.



6 WALLS AND CEILING

Lightweight material combinations, tailored to a specific purpose, can help reduce operating costs and improve passenger comfort. Armacell's new thermal and acoustic solutions provide superior performance at super-thin thicknesses.

- // ArmaComp Smart
- // ArmaComfort Rail
- // ArmaPET Struct
- // ArmaFlex Rail



7 PARTITION WALL

Partition walls in rail vehicles must be durable, easy-to-clean and equipped with all the required properties. As saving space is crucial in this area, our ArmaComfort Rail products are the optimal sound insulation solution.

- // ArmaComfort Rail
- // ArmaPET Struct

8 FRONT END

To reduce weight without compromising passenger safety, composite materials must meet the stringent fire, smoke and toxicity requirements of the rail standard EN 45545-2. In combination with appropriate laminates, ArmaPET Struct cored sandwich structures achieve the highest classification, HL3, R1 – which qualifies the material for use in all types of trains including metro, sleeper and couchette cars.

- // ArmaPET Struct

BASED ON
100%
RECYCLED
PET



9 BOARDING AREA

No matter whether folding, pivoting or sliding steps, we provide solutions for optimised thermal and acoustic insulation for the boarding devices. Our high-performance, space-saving ArmaGel Rail insulation can be integrated directly into prefabricated elements. ArmaComfort Rail offers exceptional sound transmission loss across a broad frequency range with super-thin wall thicknesses.

// ArmaGel Rail

// ArmaComfort Rail



10 LAVATORY MODULE

The supply of fresh water to washrooms and the on-board restaurant and the hygienic disposal of wastewater are taken for granted in modern trains. Our ArmaFlex Rail insulation protects hot and cold water pipes against inadmissible temperature fluctuations, which can lead to a contamination with legionella bacteria. The dust- and fibre-free material prevents condensation and thermal losses and the Microban technology offers protection against the development of bacteria and mould. Sandwich constructions based on ArmaPET ensure low life-cycle costs and greater passenger comfort. The lavatory module is just one of many possible interior applications.

// ArmaFlex Rail

// ArmaPET Struct



A high-speed train, primarily red and white, is captured in motion on a track. The background shows a blurred city skyline with tall buildings under a clear blue sky. Overhead power lines and support structures are visible above the train. The overall scene conveys speed and modern transportation.

OUR INCREASINGLY CONNECTED,
BUSIER WORLD NEEDS
TRANSPORT THAT IS LIGHTER,
SAFER AND MORE RELIABLE
THAN EVER BEFORE.

By combining conventional engineering, new technologies and creative thinking, Armacell delivers solutions that allow great ideas to come to life.

TRIED-AND-TESTED TECHNOLOGY



MOST
COST-EFFECTIVE
WAY TO SAVE
ENERGY

ARMAFLEX RAIL. INDUSTRY-LEADING INSULATION SOLUTIONS.

With our ArmaFlex Rail range we offer the first flexible closed-cell insulation with integrated fire protection for the international railway industry. Our system solutions for insulating HVAC/R and plumbing equipment ensure more safety and comfort on the tracks. They have also been successfully installed to insulate body shell parts and doors and have proven themselves as a reliable solution for rattle protection and vibration dampening in various application areas.



ARMAFLEX RAIL SD



The first closed-cell insulation to achieve the **HL2**, R1 level according to EN 45545-2. It is also classified under the national fire protection standards NFPA 130, GOST 12.1.044-89 and DIN 5510-2. Microban technology provides protection against harmful microbes and prevents the growth of mould and mildew.

ARMAFLEX RAIL SD-C



Achieves **HL3**, R1, the most stringent hazard level and is also classified according to NFPA 130 and GOST. The product is equipped with a shiny, silver covering. The attractive surface is UV-resistant, protects the insulation against mechanical impact and is very easy to clean.

CONDENSATION CONTROL AND IMPROVED INDOOR AIR QUALITY

Our closed-cell insulation with low thermal conductivity and high resistance to water vapour transmission provides installations with reliable, long-term protection against energy loss and condensation. ArmaFlex Rail products have a 'built-in water vapour barrier'. Unlike conventional insulation materials which have to be protected against moisture penetration with a separate vapour barrier, in ArmaFlex the resistance to water vapour transmission is built up throughout the entire insulation thickness.

EASY TO INSTALL



EXCELLENT FIRE BEHAVIOUR



LIFE-CYCLE COST EFFECTIVE



CONDENSATION CONTROL

ENERGY EFFICIENT

CLEAN AND SIMPLE INSTALLATION

No other insulation material can be installed as reliably, cleanly, simply or as fast as ArmaFlex. Our great advantage in tight conditions and on complex equipment is the high flexibility of our material. The homogenous, three-dimensionally linked structure allows the insulation to be cut cleanly without releasing dust or fibres which could pose a health threat if breathed in. Application times can be further reduced by using self-adhesive sheets. We offer a complete range of accessories, such as adhesives and cleaners, which have been developed especially for our products and tested as a system.

ARMAFLEX RAIL ZH



The first halogen-free, closed-cell insulation to achieve the classification **HL2**, R1. Besides having very good flame-retardant properties and low smoke density, it also minimises the risk of secondary damage due to corrosive gases which can impair (electronic) equipment in a fire.

ARMAFLEX RAIL ZH-C



This halogen-free, coated material achieves the most stringent hazard level **HL3**, R1 and can be used in operating category 4 in underground track sections or tunnels.



Our ArmaFlex Rail range includes halogen-free, Microban-protected and coated solutions and meets the requirements of EN 45545-2.

SPACE MATERIAL FOR RAILWAY APPLICATIONS



ARMAGEL RAIL. INSULATION JUST GOT BETTER.

Our vision has always been to provide innovative technical insulation solutions to conserve energy and make a difference around the world. With our new ArmaGel products that vision is now a reality and we are entering a new era in high-performance insulation.

ULTRA-THIN INSULATION FOR ULTIMATE EFFICIENCY

As one of the lightest and thinnest insulation materials in the world, aerogels are predestined for the modern railway industry. Thanks to its exceptionally low thermal conductivity, ArmaGel Rail is one of the best insulation materials available today. It is up to 80 percent thinner than conventional insulation and offers the same thermal insulation properties with only a fraction of the insulation thickness.

SPACE-SAVING DESIGN

Whether high-speed, suburban or tram trains, technology aboard rolling stock is advancing fast and becoming increasingly complex. As more and more technical equipment is installed for passengers' comfort and safety, trains become heavier and the space for insulation is reduced. ArmaGel Rail offers ultimate energy efficiency without sacrificing precious space. This super-thin, high-performance thermal insulation allows up to 5-fold space savings. The versatile material can be used on HVAC equipment and in walls, ceilings, floor and door applications where it achieves particularly slim constructions. It ensures high energy savings and cost efficiency in the long term.

UP TO
80%
THINNER
than competing
insulation products

UP TO
5x
SUPERIOR THERMAL
PERFORMANCE

OUTSTANDING PERFORMANCE

ArmaGel Rail offers convincing advantages: it is hydrophobic and breathable, protects installations against moisture and mitigates the risk of corrosion under the insulation. It also offers excellent sound insulation properties (tested according to ISO15665) and the fire behaviour achieves the most stringent hazard level, HL3 for interior (R1), exterior (R7) and cab housing (R17) applications according to EN 45545-2.

MORE THICKNESSES FOR THE BEST FIT

The double-side laminated flexible blanket has been specifically designed for railway applications. It offers superior flexibility compared to other aerogel products and is easy to install even in tight spaces. Our aerogel mats are available in 5, 10, 15 and 20 mm thicknesses and can be used on mechanical equipment with operating temperatures between -180 °C and +110 °C.

EXTRA SPACE FOR POST-PANDEMIC TRAIN DESIGNS

Due to space constraints, inadequate thicknesses of conventional insulation materials are often installed in trains, leading to high energy losses. Slimming down train structures allows space to be saved, which is becoming increasingly important for new post-pandemic rail design solutions. Our high-performance insulation materials can be integrated directly into prefabricated elements. They can be easily combined with our ArmaComfort Rail sound insulation to create tailor-made systems which make full use of the performance and advantages of each product and material.

SPACE SAVING



EXCELLENT FIRE BEHAVIOUR



ENERGY EFFICIENT

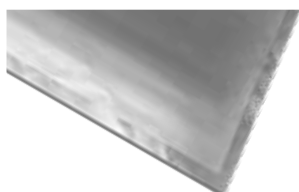


LIFE-CYCLE COST EFFECTIVE



Used by NASA to bring home a piece of a comet because it's strong enough to stop a bullet in its tracks, aerogel offers an uncanny array of physical properties and incredible potential for insulation uses. It's the world's lightest and least dense solid material.

super thin



flexible



hydrophobic



ArmaGel Rail

High energy savings and cost-efficiency in the long term.

GREATER COMFORT ON THE TRACKS



ARMACOMFORT RAIL. SUPERIOR NOISE REDUCTION WITH ULTRA-THIN THICKNESSES.

Our pioneering spirit has always been part of our DNA. Well-known for our flexible thermal insulation, we now also offer best-in-class sound attenuation technology. Our new ArmaComfort Rail products significantly reduce disturbing noise for a higher level of passenger comfort.

»Acoustic comfort is the key to enhancing customer experience and increasing rail business.«

ARMACOMFORT REFLAMEX



Visually attractive, high-performance, mass-loaded noise barrier which meets the highest requirements of the European fire protection standard EN 45545-2: **HL3** (R1), available in 2, 3, 4, 5 mm.

ARMACOMFORT RAIL ALU



Aluminium-foil-faced sound barrier, classified as **HL3** (R1). Durable and tear-resistant covering which combines an attractive silver look with an easy-to-clean surface, available in 2, 3, 4, 5 mm as standard or self-adhesive sheets.

ACOUSTIC COMFORT IS PARAMOUNT

Improving the comfort in rail vehicles is crucial for increasing the attractiveness of public transport. Fully air-conditioned high-speed trains provide fresh air and a pleasant atmosphere. The evolution in mobile and wireless communication technology allows passengers to work on board or relax undisturbed in designated quiet areas. Whether passengers are sleeping, working or communicating, acoustic comfort is paramount for the overall travel experience.

STATE-OF-THE-ART SOUND INSULATION

Factors contributing to the sound pressure level in train vehicles are numerous with rolling noise being the most important source in high-speed trains. State-of-the-art sound insulation which does not compromise the limited space and ensures an effective reduction of airborne noise in rail vehicles will become increasingly important as trains become faster and passengers' expectations rise.

SPACE-SAVING, ENVIRONMENT-FRIENDLY SOLUTION

Our ArmaComfort Rail products offer exceptional sound transmission loss properties across a broad frequency range with super-thin wall thicknesses. Based on a unique EVA/EPM blend, this new sound attenuation technology allows you to add mass to structural elements and mechanical equipment without losing space – invisibly in constructions or visibly on existing partition walls. Installed in floor and underfloor systems, ArmaComfort Rail reduces noise from tracks and brakes. It is also suitable for walls, ceilings, doors, staircases and partitions. Our solutions are tested according to EN 45545-2 and achieve the most stringent hazard level, HL3, for sleeping or couchette vehicles operating in underground track sections or tunnels. They are recyclable and halogen-free, phosphate-free, bitumen-free and lead-free. All ArmaComfort Rail products can be easily combined with our ArmaComp Smart sound absorption material and our thermal insulation solutions.

SUPERIOR ACOUSTIC PERFORMANCE



SPACE SAVING

ENVIRONMENTALLY FRIENDLY

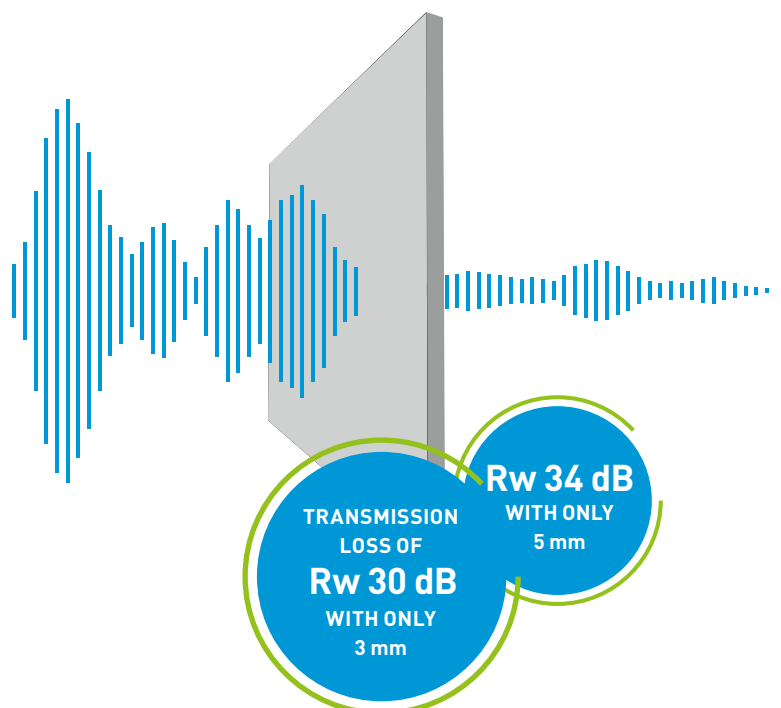


ENHANCED FIRE BEHAVIOUR

ARMACOMFORT RAIL



Black, uncovered sound barrier for interior horizontal, upward-facing surfaces and floor composites, classified as **HL3** (R10), available as 2 mm thick sheets.



NONWOVEN MADE OF PURE MELAMINE



NOISE
REDUCTION
≥ 80%
ABOVE 2,000 Hz

ARMACOMP SMART. SUPER LIGHTWEIGHT THERMAL-ACOUSTIC INSULATION.

As environmental considerations become increasingly important to passengers, the railway industry is shifting towards greater energy efficiency and sustainability without compromising passenger safety and comfort. At Armacell, we want to help shape the future of railway technology and develop new solutions to meet the current and future needs of this demanding industry.

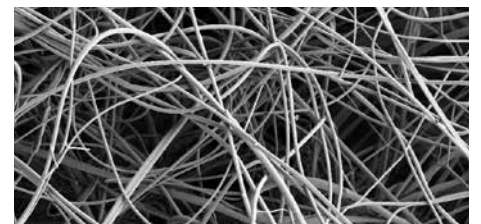
Our latest innovation, ArmaComp Smart, unifies superior thermal and acoustic insulation in a single product solution. What's more, the lightweight material provides an exceptionally low space-to-volume ratio in train carriages and enhanced energy efficiency.

THICKNESSES



ArmaComp Smart is available in thicknesses of 8, 13 and 18 mm.

WEB-LIKE STRUCTURE



The extremely fine (\varnothing 5 micron), web-like structure of ArmaComp Smart ensures exceptional sound absorbing and thermal insulation properties

LIGHTWEIGHT, HEAVY IMPACT

While the automotive and aerospace industries have used lightweight materials for decades to improve energy efficiency, the benefits of lightweight solutions have only recently been acknowledged for railway applications. ArmaComp Smart combines the properties of melamine with the specifics of a meltblown nonwoven with its extremely fine, web-like structure resulting in outstanding sound absorbing and thermal insulation properties. This new technology achieves thermal-acoustic requirements with less weight and space than legacy materials.

SUPERIOR THERMAL AND ACOUSTIC PROPERTIES

Its extremely low thermal conductivity ($\lambda_{0^{\circ}\text{C}} \leq 0,028 \text{ W/mk}$) makes it one of the most efficient insulation materials available on the market today. ArmaComp Smart offers excellent sound absorption in the low and middle frequency range and ensures a sound absorption of around 80 percent at 2,000 Hz. For a higher noise reduction at lower frequencies we recommend combining ArmaComp Smart with our ArmaComfort Rail sound barriers.

SPACE SAVING AND FIRE SAFE

With a density of 25 kg/m^3 our new non-woven is three times lighter than mineral wool offering the same or even better acoustic performance. Compared to melamine resin foams, ArmaComp Smart provides higher acoustic absorption with half the thickness. As tests according to international standards confirm, ArmaComp Smart has very low emissions of volatile organic compounds (VOCs) and odour which could impair the indoor air quality in passenger trains.

As a stand-alone product the thermal-acoustic insulation has been classified as HL2 according to EN 45545-2. Composites with ArmaComp Smart can even achieve the highest level of safety (HL3), allowing them to be installed in couchettes and sleeping cars that travel in underground tunnels. The nonwoven is available in thicknesses of 8, 13, 18 mm and is optimised for use on flat surfaces.

LIGHTWEIGHT



ACOUSTIC ABSORPTION



INDOOR AIR QUALITY



SPACE SAVING

ENERGY EFFICIENT

» Our best-in-class thermal and acoustic insulation for an ever lighter and more sustainable rail industry. «



3x

LIGHTER THAN
MINERAL
WOOL

DESIGNED FOR A CLEANER TOMORROW



ARMAPET. RECYCLING PLASTICS INTO HIGH-TECH FOAM.

ArmaPET Struct is the versatile and durable solution for structural sandwich applications with a more environmentally responsible approach. It allows fire safety solutions that ensure passenger protection while enhancing the cost-effective operation of your rolling stock.



Today's train operators and manufacturers are challenged by the need for even lighter, more energy-efficient and environment-friendly trains that do not compromise on safety or durability. With ArmaPET, we offer the rail vehicle construction industry a lightweight and durable product solution for safer, more sustainable and cost-efficient operation.



CONTRIBUTING TO ECO-FRIENDLY TRAVEL

ArmaPET offers a more sustainable product solution and contributes to eco-friendly travel. Based on 100% recycled material with full recyclability after service life, ArmaPET enables train operators and manufacturers to present a more sustainable final product solution. It requires less energy for its production than conventional foam core materials.

Compared to PVC, ArmaPET Struct delivers 38% savings on CO₂ emissions, and compared to polyurethane even 53%.

LIGHTWEIGHT



LOW SMOKE AND TOXICITY LEVEL



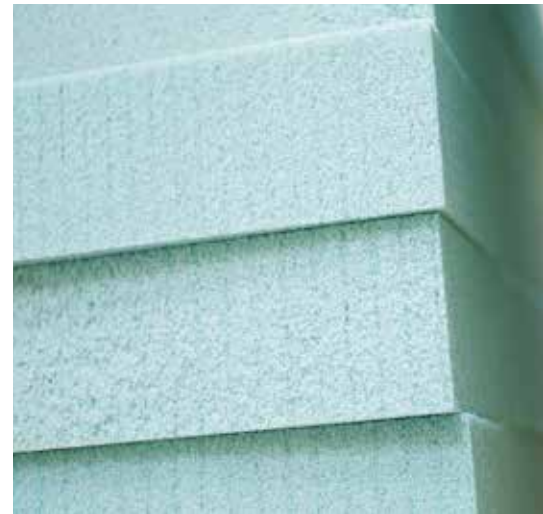
LONG-TERM PERFORMANCE



LIFE-CYCLE COST EFFECTIVE



SUSTAINABLE



ArmaPET Struct FR
fire-retardant, self-extinguishing foam cores fulfilling EN 45545-2 requirements.

ARMAPET STRUCT FR

ArmaPET Struct FR is a halogen-free product with very low smoke generation and reduced smoke toxicity that enhances rail passenger fire safety. EN 45545-2 compliance up to hazard level HL3, R1 is feasible.

In addition to its excellent fire safety performance, ArmaPET Struct FR provides a durable final product with superior impact resistance to ensure long-term performance, fewer repairs and easy maintenance in use. Its unique combination of material and processing properties, enhance efficiency throughout the manufacturing process of your composite structure: regular processing temperature of +150°C / +302°F, density variation of less than 5 percent, compatibility with infusion and pre-preg lamination processes and all common resin systems and thermoformability into 3D or double-curved sandwich panels, to name just a few.

ARMAPET SHAPE

ArmaPET Shape is the first fully recyclable mouldable particle foam made entirely of recycled plastics. It combines the high mechanical properties of structural foam core with the advantages of particle foams to offer maximum design flexibility for lightweight, strong, ready-to-use 3D foam parts in nearly any shape.



ArmaPET Shape
PET-based particle foam for 3D structural foam parts.

ARMAPET CURVE

ArmaPET Curve is the first 100 percent recyclable thermoplastic foil product based on 100 percent recycled plastics. Superior stiffness and compression combined with chemical and temperature stability characterise our innovative technical solution for thin flexible PET-based sheets. ArmaPET Curve is designed for recyclable thermoformable micro-sandwich solutions produced in continuous manufacturing processes.



ArmaPET Curve
PET-based foil product for thermoforming applications.



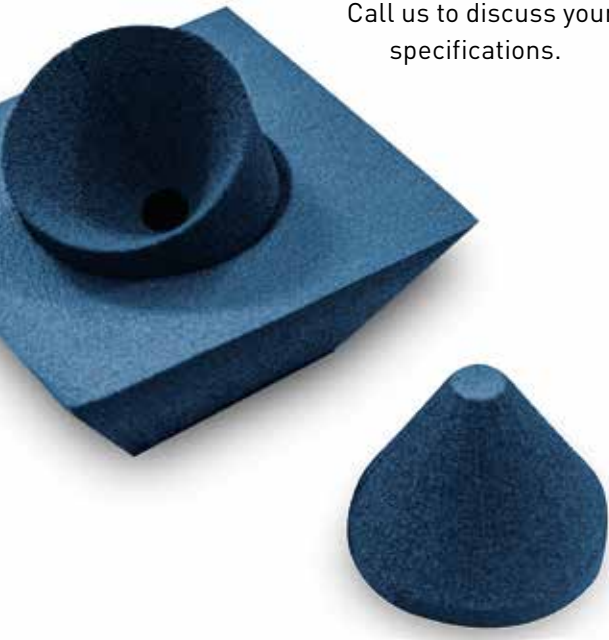
AT YOUR SERVICE.

At Armacell, we are committed to creating an exceptional customer experience. We understand the challenges in today's railway industry and are here to help you complete your projects successfully. From planning to handover – our 360 degree service supports you throughout. By sharing know-how based on our extensive experience we strive to help you solve your unique project challenges. At Armacell, we do all we can to make sure your projects stay on track.

ARMACELL'S CUSTOMISED SOLUTIONS

Take the fast track and get your ArmaFlex Rail fittings trimmed by our professional waterjet-cutting technology. Just provide us with CAD or DXF files of the shapes you need and we will make prototypes. Our machines cut smooth, precise edges in any two- or three-dimensional shape. We provide full-service cutting capabilities and can deliver your order in the quantity and sequence you need to install it in the workshop.

Call us to discuss your specifications.



ARMAFLEX APPLICATION TRAINING

To ensure that our insulation materials are installed properly, Armacell has trained thousands of installers around the world. Special training centres have been set up at many locations and we also provide valuable support on site. Several thousand insulators attend courses on installing Armacell products every year and are awarded the ArmaFlex application certificate.

Valuable tips and tricks
Don't miss out on our application training. You will learn to install ArmaFlex more reliably and faster than you do today.



ARMWIN – PROFESSIONAL INSULATION CALCULATIONS

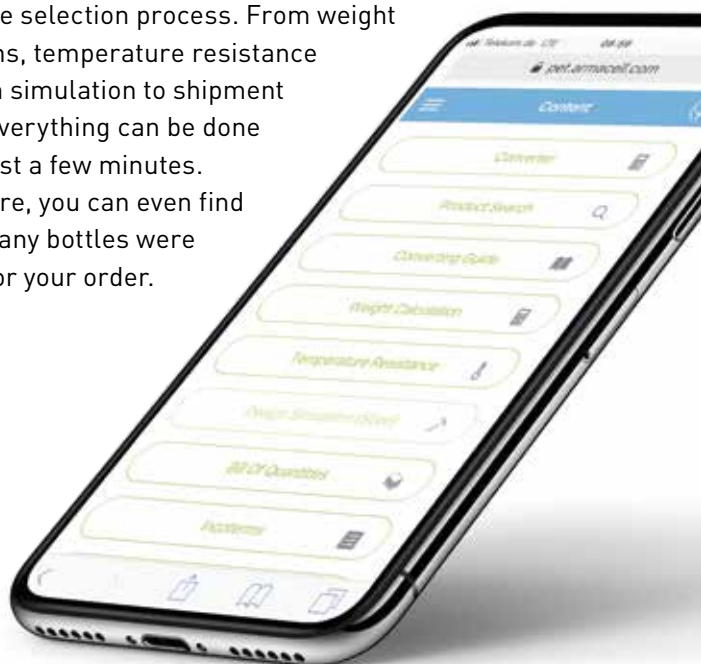
With our powerful ArmWin software you can carry out all common technical calculations in HVAC applications – even on the building site, thanks to the app. You can easily determine the minimum insulation thickness required for condensation control, plus surface temperature, heat flow, temperature changes in flowing and stationary media, freezing times for water pipes and the most economical insulation thicknesses, i.e. those with the shortest pay-back periods.



ArmWin
All technical insulation calculations in one tool.

ARMASELECT – COMPOSITE CORE SELECTION

With our new ArmaSelect tool the appropriate product for your sandwich construction is just a few clicks away. Based on mechanical considerations and your specific requirements this easy to use tool leads you step-by-step through the selection process. From weight calculations, temperature resistance and design simulation to shipment details – everything can be done easily in just a few minutes. What's more, you can even find out how many bottles were recycled for your order.



ArmaSelect
Easy specification of the appropriate core material for your project.

DECADES OF EXPERIENCE IN RAILWAY TECHNOLOGY.

With more than 50 years of experience in the railway industry, Armacell supplies technology you can rely on. We are experts in railway applications and our product range has been specifically designed to meet the special requirements of this industry.

At Armacell, safety comes first and maximum reliability is essential. We know the railway requirements and standards and offer global support. The European standard EN 45545-2 which came into force in 2013 and replaced all national standards in 2016 defines tighter requirements for the fire behaviour of materials and components.

WITH
ARMACELL
YOU'RE ALWAYS ON
THE SAFE SIDE



The objectives of this standard are to minimise both the risk of a fire starting and spreading within railway vehicles and its effects on passengers and staff. As a consequence, this provides the best level of protection against a fire starting on board.



To achieve the highest possible level of safety in trains, both materials and components must meet strict fire, smoke and toxicity requirements. Depending on where they are used, materials are assigned to the categories R1 to R26 (R = Requirement Set).

The various operating and design classes provide the basis for the hazard levels (HLs) which in turn define the requirements of the classification system. There are a total of three hazard levels (HL1 to HL3). HL3 is the highest level and thus makes the highest demands of the materials used.

- // As of April 2016 all national standards were replaced by EN 45545-2
- // All trains are now built according to new European law
- // Armacell's solutions for the railway industry can now be specified and installed throughout Europe

NATIONAL STANDARDS REPLACED BY EN 45545-2

Country	Standard	European Standard	Testing Standard
Great Britain	BS 476-6/7	EN 45545-2	Spread of flame ISO 5658-2
France	NF 16 101 NF 16 102	Railway application	Heat release, smoke production and mass loss rate ISO 5660
Germany	DIN 5510	Fire protection on railway vehicles	Smoke optical density and toxicity EN ISO 5659-2
Italy	UNI CEI 11170		
Poland	PN-K-02511	Requirements for fire behaviour of materials and components	

TYPE OF VEHICLE AND OPERATION DETERMINE THE REQUIRED HAZARD LEVEL



	N: Standard vehicles	A: Vehicles of automatic train, no emergency trained staff on board	D: Double decked vehicles	S: Sleeping / couchette vehicles
1: No underground lines.	HL1	HL1	HL1	HL2
2: Regular use of underground sections and tunnels. Fast evacuation possible.	HL2	HL2	HL2	HL2
3: Regular use of underground sections and tunnels. Slow evacuation possible.	HL2	HL2	HL2	HL3
4: Regular use of underground sections and tunnels (incl. Euro-Tunnel). No evacuation possible.	HL3	HL3	HL3	HL3

HL1
e.g. tramway

HL2
e.g. TGV, TER,
RER, subway

HL3
e.g. subway,
metro, couchette
wagon

FIRE STANDARD
EN 45545 TAKES THE
FIRST PRINCIPLES INTO
CONSIDERATION

- F**lame spread
- I**gnitability
- R**ate of heat release
- S**moke emissions
- T**oxic gas emissions



CRH3A BULLET TRAIN

The CRH3A bullet train connects the cities of Chengdu and Xi'an in Western China, travelling the 700 km in less than four hours and transporting passengers at speeds of up to 250 km/h. ArmaPET was selected as a lightweight structural core material for the train's nose because of its thermoformability, fatigue resistance and process versatility. The success of the CRH3A has put an end to flights between the two cities, reducing the carbon footprint on this route.



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Coradia

// **Hitachi**

AT300
Caravaggio

// **CRRC**

Melbourne Metro
Switzerland Metro
Shanghai Metro
CRH3A bullet train

// **Kawasaki**

Taipei Metro

// **Taiwan Rolling Stock Co.,Ltd**

Taiwan Metro Danhai Line
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// **Hosue (Wabtec Group)**

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As the inventors of flexible foam for equipment insulation and a leading provider of engineered foams, Armacell develops innovative and safe thermal, acoustic and mechanical solutions that create sustainable value for its customers. Armacell's products significantly contribute to global energy efficiency making a difference around the world every day. With 3,000 employees and 23 production plants in 15 countries, the company operates two main businesses, Advanced Insulation and Engineered Foams. Armacell focuses on insulation materials for technical equipment, high-performance foams for high-tech and lightweight applications and next generation aerogel blanket technology. For more information, please visit: www.armacell.com.

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