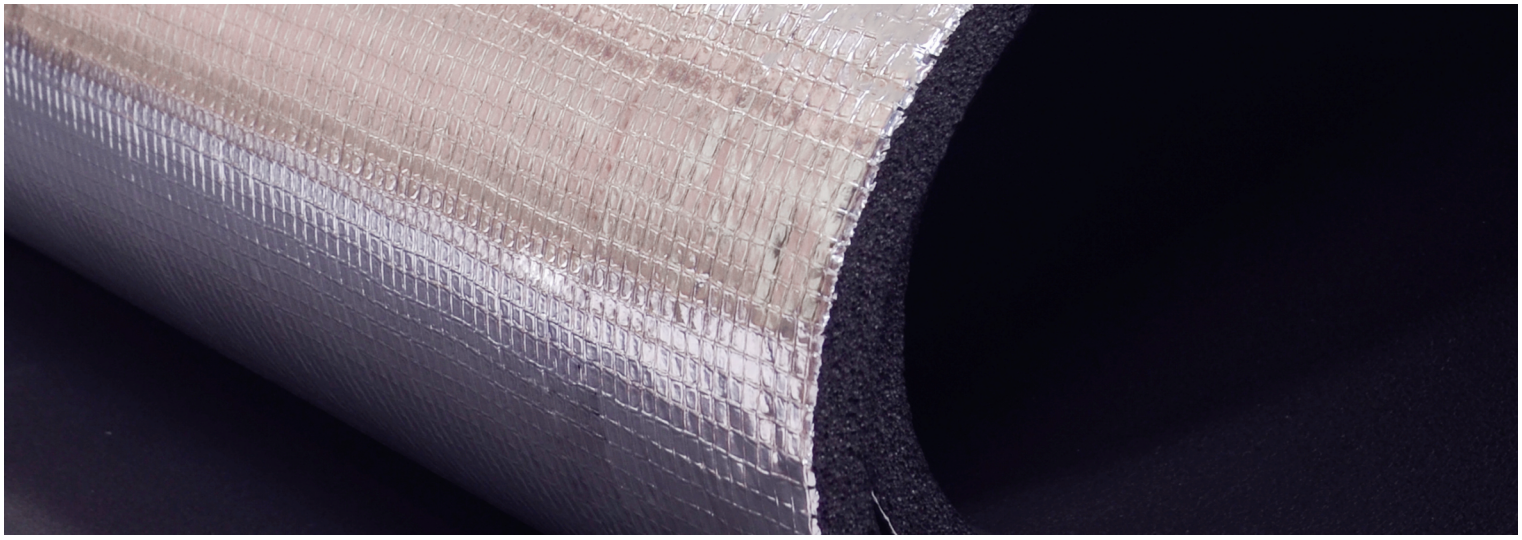
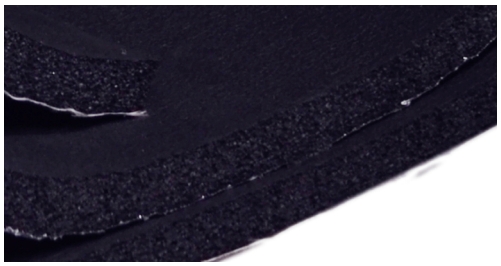


ADVANCED THERMAL PROTECTION FOR RAILWAY COACHES

ArmaFlex RL



Flexible closed-cell insulation to meet hazard level 3 of requirement set R1 for railway coaches according to EN45545

// Built-in water vapour barrier reduces risk of corrosion underinsulation (CUI)
// Low smoke density
// Does not generate flaming droplets
// Better finish

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FIRE STANDARD EN 45545-2 TAKES THE **FIRST** PRINCIPLES INTO CONSIDERATION

Flame spread
Ignitability
Rate of heat release
Smoke emissions
Toxic gas emissions

EN 45545-2 "Railway applications. Fire protection on railaway vehicles." is a seven-part European standard for fire protection on railway vehicles. 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 employees. As a consequence, this provides **the best level of protection against the occurrence of a fire 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 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.

TYPE OF VEHICLE AND OPERATION DETERMINE THE REQUIRED HAZARD LEVEL

Operation category (OC)	N: Standard vehicles	A: Vehicles of automatic train, no emergency trained staff on board	D: Double decked vehicles	S: Sleeping / couchette vehicles
OC1: Railway vehicles may be stopped with minimum delay, and where a safe area can always be reached immediately.	HL1	HL1	HL1	HL2
OC2: Vehicles for operation on underground sections, tunnels and/ or elevated structures, with side evacuation available and where there are stations or rescue stations that offer a place of safety to passengers, reachable within a short running time.	HL2	HL2	HL2	HL2
OC3: Vehicles for operation on underground sections, tunnels and/ or elevated structures, with side evacuation available and where there are stations or rescue stations that offer a place of safety to passengers, reachable within a long running time.	HL2	HL2	HL2	HL3
OC4: Vehicles for operation on underground sections, tunnels and/ or elevated structures, without side evacuation available and where there are stations or rescue stations that offer a place of safety to passengers, reachable within a short running time.	HL3	HL3	HL3	HL3

EN 45545-2 specifies the test methods, test conditions and reaction to fire performance requirements for all onboard materials and components used on railway vehicles as defined by the HL. Key fire tests defined in this standard are flame propagation, cone calorimeter and the smoke and toxicity tests. For requirement set R1, they are all based on radiant panels with 50 kW/m² heat fluxes.

REQUIREMENT SET FOR R1 (INSULATION MATERIAL)

European standard	Test standard	Parameter unit	Requirement definition	HL1	HL2	HL3
EN 45545-2	Spread of flame ISO 5658-2	CFE kWm^{-2}	Minimum	20	20	20
Railway application. Fire protection on railway vehicles - Requirements for fire behaviour of materials and components.	Heat release, smoke production and mass loss rate ISO 5660-1	MARHE kWm^{-2}	Maximum		90	60
	Smoke optical density and toxicity EN ISO 5659-2	$D_S(4)$ dimensionless	Maximum	600	300	150
		VOF_4	Maximum	1200	600	300
		CIT_G dimensionless	Maximum	1.2	0.9	0.75

TECHNICAL DATA - ARMAFLEX RL

Brief description	Highly flexible, closed-cell pre-covered insulation foam with improved fire retardant properties and low smoke density for railway vehicles.
Material type	Elastomeric foam based rubber pre - covered with Aluminium Foil.
Colour	Silver
Material special information	Laminated with special aluminium foil, with reinforced glass scrim.
Product range	Available in rolls (sheet) of 1m width and thicknesses of 6mm, 9mm, 13mm, 16mm, 19mm, 25mm and 32mm thicknesses and tubes. The above sizes are available in self-adhesive rolls (sheet), for the application and temperature requirement for self-adhesive sheets consult with Armacell technical team.
Applications	Prevent condensation and enable energy efficiency through insulation of air-conditioning systems such as air ducts.
Special features	Bright silver finish and smooth surface; attracts less dust, is easy to clean and has high resistance to mechanical abuse.
Assembly	Insulation / Protection for air ducts & pipes (inclusive of elbows, fittings, flanges, etc.) of air conditioning / refrigeration systems to prevent condensation. ArmaFlex is recommended to be used together with ArmaFlex adhesive such as ArmaFlex 520.

Property	Value/Assessment						Standard/Test method
Temperature range							
Service temperature	Maximum service temperature	105 °C		+85 °C if sheet or tape is glued to the object with its entire surface.			Tested according to EN 14706, EN 14707, EN 14304
	Minimum service temperature	-40 °C[2]					
Thermal conductivity							
	θm	-20	0	+20	+40	[°C]	Tested according to EN 12667
	λ ≤	0.033	0.035	0.037	0.039	[W/(m·K)]	
Water vapour diffusion resistance							
Water vapour diffusion resistance factor	μ ≥ 12,000						Tested according to EN 12086
Water absorption							
Water absorption (by volume)	0.2%						Tested according to ASTM C 1763
Fire performance and approvals							
Reaction to fire	Hazard level	HL3, R1					EN 45545-2
Flammability	HB, V-0						Tested according to UL-94
Practical fire behaviour	Self-extinguishing, does not drip and does not spread flames.						
Other technical features							
Resistance to mechanical impact	Good						
Chemical behaviour	Excellent resistance to ozone, oil and chemicals (consult product test list).						
Environmental aspect[1]	Zero ozone depletion potential, zero global warming potential.						
Storage	Shall be stored in dry and clean area, away from direct sunlight.						

All data and technical informationare based on results achieved under typical application conditions. Recipients of this information should, in their own interest and responsibility, clarify with us in due time whether or not the data and information apply to the intended application area. Installation instructions are available in our ArmaFlex installation manual.

1 All data and technical information are provided above are based on results achieved under tests certified by the respective testing authorities for base foam only and not the complete system.
2 For negative temperature applications consult with Armacell technical team.

ArmaFlex | ArmaFlex RL | TDS | 072023 | en-IN

ABOUT ARMACELL

As the inventor of flexible foam for equipment insulation and a leading provider of engineered foams, Armacell develops innovative and safe thermal 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 more than 3,300 employees and 27 production plants in 19 countries, the company operates two main businesses, Advanced Insulation and Engineered Foams. Armacell focuses on insulation materials for technical equipment, high-performance foams for acoustic and lightweight applications, recycled PET products, next-generation aerogel technology and passive fire protection systems.

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