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INSULATION

TROCELLEN CLASS TRAIN

Thermal insulation and fire protection
for railways



Trocellen Class Train

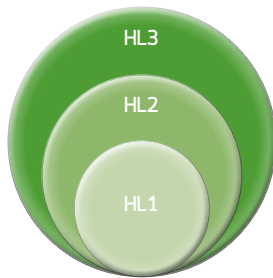
TROCELLEN CLASS TRAIN is the certified product line for railway industry. It is realized in close cell, chemically cross-linked polyethylene foam, laminated, from one side, with an aluminium sheet.

The product is available in adhesive rolls, thicknesses from 3 to 40 mm.

TROCELLEN CLASS TRAIN is certified **R1 HL3**, according to the norm **EN 45545-2** "Fire protection on railway vehicles. Part 2: Requirements for fire behaviour of materials and components".

EN 45545 norms indicate requirements of materials and components to be installed in railway vehicles with the aim of guaranteeing the protection of passengers and staff, in the event of a fire on board.

The above mentioned norms introduce the concept of hazard level of a vehicle (HL1, HL2 and HL3, depending on increasing hazard), as a combination of two elements: the operational category (OC) and the design category, that is related to the type of rolling stock.



Hazard level



OPERATION CATEGORIES (OC)	DESIGN CATEGORIES			
	N STANDARD VEHICLES	A VEHICLES FORMING PART OF AN AUTOMATIC TRAIN HAVING NO EMERGENCY TRAINED STAFF ON BOARD	D DOUBLE DECKED VEHICLE	S SLEEPING AND COUCHETTE VEHICLES
OC 1 Vehicles for operation on infrastructure where railway vehicles may be stopped with minimum delay, and where a safe area can always be reached immediately	HL1	HL1	HL1	HL2
OC 2 Vehicles for operation on underground sections, tunnels and/or elevated structures, with side evacuation available and where there are stations that offer a place of safety to passengers, reachable within a short running time	HL2	HL2	HL2	HL2
OC 3 Vehicles for operation on underground sections, tunnels and/or elevated structures, with side evacuation available and where there are stations that offer a place of safety to passengers, reachable within a long running time	HL2	HL2	HL2	HL3
OC 4 Vehicles for operation on underground sections, tunnels and/or elevated structures, without side evacuation available and where there are stations that offer a place of safety to passengers, reachable within a short running time	HL3	HL3	HL3	HL3

Hazard level classification according to EN 45545-2
HL3 > HL2 > HL1

Depending on the type of product to install and its position within the rail vehicle, the EN 45545-2 norm indicates 26 requirements to be fulfilled: R1 is the specific requirement for insulation materials.

In detail, R1 requirement refers to:

- **Interior vertical surfaces** (walls, partitions, doors, windows, insulation materials, kitchen interior surfaces..)
- **Interior horizontal downward-facing surfaces** (ceiling paneling, insulation materials..)
- **Interior surfaces within cavities** (horizontal or vertical)
- **External surfaces of enclosures containing technical equipment** (inside the body shell)
- **Luggage storage areas**
- **Driver's desk** (paneling and surfaces of the driver's desk)
- **Interior surfaces of gangways** (interior side of gangway membrane, interior lining of the gangway)
- **Window frames** (including sealants and gaskets)
- **Curtains and sunblind in passenger area and staff area, staff compartments**
- **Tables, folding tables downward facing surface**
- **Litter bins and ashtrays**
- **Air ducts - Interior surfaces**
- **Air ducts - Exterior surfaces**
- **Devices for passenger information** (information display screens in passenger areas)
- **Underside surface of couchettes and beds**

For each requirement are determined the tests to be performed, the parameters to be evaluated and the values to be met, according to the corresponding hazard levels (from HL1 to HL3).



R1:	MATERIAL REQUIREMENT SET FOR R1					
	TEST METHOD REFERENCE	PARAMETER AND UNIT	MAXIMUM OR MINIMUM	HL1	HL2	HL3
IN11 - Interior vertical surfaces (walls, partitions, doors, windows, insulation materials, kitchen interior surfaces.)	T02 ISO 5658-2	CFE kW/m ²	Minimum	20*	20*	20*
IN1B - Interior horizontal downward-facing surfaces (ceiling paneling, insulation materials..)	T03.01 ISO 5660-1: 50 kW/m ²	MARHE kW/m ²	Maximum	- *	90	60
IN1D - Interior surfaces within cavities (horizontal or vertical)	T10.01 EN ISO 5659-2: 50 kW/m ²	D _s (4) adimensional	Maximum	600	300	150
IN1E - External surfaces of enclosures containing technical equipment (inside the body shell)	T10.02 EN ISO 5659-2: 50 kW/m ²	VOF ₄ min	Maximum	1.200	600	300
IN4 - Luggage storage areas	T11.01 EN ISO 5659-2: 50 kW/m ²	CIT ₆ adimensional	Maximum	1,2	0,9	0,75
IN5 - Driver's desk (paneling and surfaces of the driver's desk)						
IN6A - Interior surfaces of gangways (interior side of gangway membrane, interior lining of the gangway)						
IN7 - Window frames (including sealants and gaskets)						
IN8 - Curtains and sunblind in passenger area and staff area, staff compartments						
IN9B - Tables, folding tables downward facing surface						
IN11 - Litter bins and ashtrays						
IN12A - Air ducts - Interior surfaces						
IN12B - Air ducts - Exterior surfaces						
IN14 - Devices for passenger information (information display screens in passenger areas)						
F5 - Underside surface of couchettes and beds						

* If flaming droplets/particles are reported during the test ISO 5658-2, or for the special case of materials which do not ignite and are additionally reported as unclassifiable, the following requirements shall be added: Test to the requirements of EN ISO 11925-2 with 30s flame application.

The acceptance requirements are:

- flame spread < 150 mm within 60s
- no burning droplets/particles



CHARACTERISTICS

TROCELLEN CLASS TRAIN represents the ideal solution for the thermal insulation and the protection to fire for railways.

Characteristics and advantages:

- made of long lasting closed cell polyethylene insulation foam;
- very good reaction to fire;
- classified **R1 HL3** according to **EN 45545-2**;
- suitable to be installed in any rolling stock category, even in sleeping and couchette vehicles;
- good thermal conductivity (λ at 0 °C: 0,038 W/mK);
- constant insulation value for at least 23 years, probably longer *;
- closed cells, to inhibit water absorption;
- clean, non toxic, mould and bacteria resistant, odorless;
- flexible enough to follow tight angles and strong enough to withstand rough handling;
- economically convenient.



* **TROCELLEN** products tested after 23 years of operation found the same insulating value. Test reports available on request.

TECHNICAL DATA			
TECHNICAL CHARACTERISTICS	NORM	UNIT	TROCELLEN CLASS TRAIN ALU ADHESIVE
Reaction to fire	EN 45545-2	-	R1 HL3
Thermal conductivity coefficient at 0 °C (λ -value)	EN 12667	W/mK kcal/mh°C	0,038 0,032
Thermal conductivity coefficient at 23 °C (λ -value)	EN 12667	W/mK kcal/mh°C	0,040 0,034
Thermal conductivity coefficient at 40 °C (λ -value)	EN 12667	W/mK kcal/mh°C	0,042 0,036
Water vapour diffusion factor (μ -value)	EN 10456	-	≥ 15000
Density (PE)	EN ISO 845	kg/m ³	30
Thickness	EN ISO 1923	mm	from 3 to 40 (see base specifications)
Colour	Spec. BASE	-	light blue + aluminium sheet
Compression stress at 25%	EN ISO 3386/1	kPa	35
Compression stress at 50%	EN ISO 3386/1	kPa	95
Water absorption after 28 days	ISO 2896	Vol.%	<3
Dimensional stability (< 5%)	ISO 2796	°C	100
Maximum operative temperature range		°C	-80÷ +100
Maximum operative temperature range with mechanical stress		°C	-40÷ +100

ACCESSORIES – TAPES – STRIPS

ALUMINIUM TAPES

To guarantee a good aesthetic finishing, the product range also contains a series of aluminium tapes.

Range:

- thickness 50 μm , types embossed, smooth, self-adhesive (smooth or embossed), Duplex (with polyester film, improved tensile strength and adhesiveness).

TROCELLEN CLASS TRAIN STRIPS

Suitable for the technical and aesthetic finishing of the insulation, they can be used for sections of piping where it is difficult to apply insulating sleeves and for joints.

Range:

- thickness 3 mm, type **TROCELLEN CLASS TRAIN ALU ADHESIVE**

ITEM SPECIFICATION

TROCELLEN CLASS TRAIN ALU ADHESIVE

Chemically cross-linked, closed cell polyethylene, density 30 kg/m^3 , light blue, adhesive from one side and laminated from the other side with a smooth aluminium sheet.

Usable for the thermal insulation and protection to fire for railways.

- Reaction to fire: classified R1 HL3, according to EN 45545-2
- Thermal conductivity coefficient at 0 $^{\circ}\text{C}$ (λ -value)= 0,038 W/mK (0,032 $\text{kcal/mh}^{\circ}\text{C}$)
- Water vapour diffusion factor (μ -value) ≥ 15000

INTERNATIONAL LOCATIONS

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TROCELLEN*

Trocellen is the first choice European polyolefin foam-solution provider. Through continuous innovations and successful partnerships we dedicate ourselves to one goal: protecting and providing comfort for people.

After more than 40 years, with 600 employees at seven sites and many cooperating companies, various partner universities, institutes and designers we offer solutions for our business partners in various industries such as construction and insulation, automotive, leisure and professional sport, adhesive tapes, footwear and packaging.

*Trocellen is the member of Furukawa Group.

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50° 49' N	07° 09' O	Germany
40° 28' N	03° 21' O	Spain
41° 53' N	12° 28' O	Italy
47° 30' N	19° 02' O	Hungary
02° 54' N	101° 28' O	Malaysia
35° 40' N	139° 49' O	Japan FURUKAWA

