



RAIL APPLICATIONS

## ABOUT ISOVOLTA

*State-of-the-art production methods,  
innovative products, international production facilities,  
global customer relationships*

**I**sovolta Group is a leading international manufacturer of electrical insulating materials, technical laminates and composites and maintains a global presence. Material and technology know-how, flexibility and an excitement about innovation define product development and shape the cooperative customer relationships.

Since 1949 customers can rely on the broad ISOVOLTA product portfolio with customised and innovative new product developments. The ISOVOLTA Group stands for solution-oriented thinking with the courage to implement intelligent alternatives.

### Our Competence

- Rigorously tested and high quality raw materials
- Impregnation
- Coating
- Lamination
- Processing
- Resin systems
- Customizing (cutting, punching, machined parts)
- 3D-Printing
- Pressing of laminates
- Curing of tubes and rods

## INTRODUCTION OF EN 45545-2:2013-08

**T**he EN45545 regulates the design of railway vehicles and various components integrating the target to limit the risk of people getting hurt in case of fire, due to fire spread and generated gases.

**Due to the large diversity of the railway materials, the EN45545 standard has created:**

- EN 45545-1, section 5 defines the relevant operation and design categories
- Classification by operation category (OC) primarily depends on the time required for evacuating vehicles that are designed or equipped for surface operation (OC1) or tunnel operations (short tunnel, long tunnel, side evacuation possible).
- Whereas the design category considers if the vehicles are part of an automatic train (without emergency-trained staff on board, category A), double-decked vehicles (category D), sleeping and couchette vehicles (category S) or other vehicles (standard vehicles, category N).

	N (normal/standard)	A (automatic operation)	D (double deck)	S (sleeping car)
Surface operation	HL 1	HL 1	HL 1	HL 2
Tunnel < 5 km	HL 2	HL 2	HL 2	HL 2
Tunnel > 5 km	HL 2	HL 2	HL 2	HL 3
No side evacuation possible	HL 3	HL 3	HL 3	HL 3

The level risks are used to classify the requirements of the fire security of the materials (statement from the standard EN45545-2).

ISOVAL® 10 FKB (EP GC 310)

HL1, HL2 & HL3 classification acc. to the requirements R22, R23, R24 & R25 in a thickness range from 1,5 - 25 mm.

				Thickness 1,5 mm	Thickness 3 mm	Thickness 10,5 mm	Thickness 25 mm
Oxygen concentration	T01	EN ISO 4589-2	Vol. %	100	100 (1,5 mm)	100	100 (10,5 mm)
Smoke density D <sub>s</sub> max	T10.03	EN ISO 5659-2 / 25 kW/m²		27	-	-	1
Smoke toxicity CIT <sub>NLP</sub>	T12	NF X 70-100 / 600°C		0,04	0,04	0,04	0,04
Glow-wire based test	T16	EN 60695-2-11	°C	-	960	-	-

ISOVAL® 11 HKB (EP GC 306 & 308)

HL1, HL2 & HL3 classification acc. to the requirements R22, R23 & R24 in a thickness range from 0,8 - 25 mm.

				Thickness 0,8 mm	Thickness 25 mm
Oxygen concentration	T01	EN ISO 4589-2	Vol. %	45,9 ( 3 mm)	45,9 (3 mm)
Smoke density D <sub>s</sub> max	T10.03	EN ISO 5659-2 / 25 kW/m²		61	3
Smoke toxicity CIT <sub>NLP</sub>	T12	NF X 70-100 / 600°C		0,08	0,08

ISOVAL® FR4-HF (EP GC 202 & EP GC 310)

HL1, HL2 & HL3 classification acc. to the requirements R22, R23 & R24 in a thickness range from 3,1 - 26 mm.

				Thickness 3,1 mm	Thickness 26 mm
Oxygen concentration	T01	EN ISO 4589-2	Vol. %	80	80 (3,1 mm)
Smoke density D <sub>s</sub> max	T10.03	EN ISO 5659-2 / 25 kW/m²		12	< 1
Smoke toxicity CIT <sub>NLP</sub>	T12	NF X 70-100 / 600°C		0,12	0,12

ISOVAL® TU 22 HKB

HL1, HL2 & HL3 classification acc. to the requirements R23 & R24 in a thickness range from 1,2 - 3,1 mm.HL1 & HL2 classification acc. to the requirements R22 in a thickness range from 1,2 - 3,1 mm.

				Thickness 1,2 mm	Thickness 3,1 mm
Oxygen concentration	T01	EN ISO 4589-2	Vol. %	43,6 (3,1 mm)	43,6 (3,1 mm)
Smoke density D <sub>s</sub> max	T10.03	EN ISO 5659-2 / 25 kW/m²		118	169
Smoke toxicity CIT <sub>NLP</sub>	T12	NF X 70-100 / 600°C		0,08	0,08

VOLTIS® PE 203 (similar to UP GM 203)

HL1, HL2 & HL3 classification acc. to the requirements R23 & R24 in a thickness range from 3,9 - 25,1 mm.HL1 & HL2 classification acc. to the requirements R22 in a thickness range from 3,9 - 25,1 mm.

				Thickness 3,9 mm	Thickness 25,1 mm
Oxygen concentration	T01	EN ISO 4589-2	Vol. %	32,9 (2,9 mm)	32,9 (2,9 mm)
Smoke density D <sub>s</sub> max	T10.03	EN ISO 5659-2 / 25 kW/m²		296	9
Smoke toxicity CIT <sub>NLP</sub>	T12	NF X 70-100 / 600°C		0,04	0,04

VOLTIS® PE 205 (UP GM 205)

HL1, HL2 & HL3 classification acc. to the requirements R22, R23 & R24 in a thickness range from 4 - 25 mm.

				Thickness 4 mm	Thickness 25 mm
Oxygen concentration	T01	EN ISO 4589-2	Vol. %	68,8	68,8 (4 mm)
Smoke density D <sub>s</sub> max	T10.03	EN ISO 5659-2 / 25 kW/m²		51	5
Smoke toxicity CIT <sub>NLP</sub>	T12	NF X 70-100 / 600°C		0,04	0,04



COMPOSITE  
MATERIALS

Materials according to EN 45545-2:2013-08

Requirement	T10.03 EN ISO 5659-2 25 kW/m² D <sub>s</sub> max			T01 EN ISO 4589-2 Oxygen concentration Vol. - %			T12 NF X70-100-1 und 2 600 °C CIT <sub>NLP</sub>			T16 EN 60695-2-11 Glow-wire based test min. GWFI		
	HL 1	HL 2	HL 3	HL 1	HL 2	HL 3	HL 1	HL 2	HL 3	HL 1	HL 2	HL 3
R22	≤ 600	≤ 300	≤ 150	≥ 28	≥ 28	≥ 32	≤ 1,2	≤ 0,9	≤ 0,75	-	-	-
R23	-	≤ 600	≤ 300	≥ 28	≥ 28	≥ 32	-	≤ 1,8	≤ 1,5	-	-	-
R24	-	-	-	≥ 28	≥ 28	≥ 32	-	-	-	-	-	-
R25	-	-	-	-	-	-	-	-	-	850	850	850
Result												
Isoval® 10 FKB	27	27	27	100	100	100	0,04	0,04	0,04	960	960	960
Isoval® 11 HKB	61	61	61	45,9	45,9	45,9	0,08	0,08	0,08	-	-	-
Isoval® FR4-HF	12	12	12	80	80	80	0,12	0,12	0,12	-	-	-
Isoval® TU 22 HKB	169	169	169	43,6	43,6	43,6	0,08	0,08	0,08	-	-	-
Voltis® PE 203	296	296	296	32,9	32,9	32,9	0,04	0,04	0,04	-	-	-
Voltis® PE 205	51	51	51	68,8	68,8	68,8	0,04	0,04	0,04	-	-	-

## 1 CONDUCTOR INSULATION

Flexible calcined mica paper tapes with modified epoxy or silicone resin on a polyimide film carrier, for single conductor insulation.

### CONDUCTOFOL® K 2010

Standard type with modified epoxy resin for high thermal stress.

### CONDUCTOFOL® K 2011

Polyimide film and silicone resin.

### CONDUCTOFOL® K 3470

Polyimide film is additionally covered with a melting adhesive that can be used for preconsolidation of coils/bars.

### CONDUCTOFOL® CR 2542

Special polyimide film provides a high partial discharge resistance and very good thermal stability.

## 2 MAINWALL INSULATION

Porous mica paper tapes with low resin content having a glass cloth as carrier for continuous mainwall insulation.

### POROBAND® SI 0790

Calcined mica paper reinforced by aramid fibres and a glass cloth carrier for silicone-based systems.

### POROBAND® KSI 2566

Uncalcined mica paper, modified silicone resin and a glass cloth as carrier. The mica paper is additionally covered with a polyimide film.

### POROBAND® PIN 2851

Uncalcined mica paper reinforced by aramid fibres, modified epoxy resin and a glass cloth as carrier. The mica paper is additionally covered with a polyimide film.

## 3 CONNECTIONS / END WINDINGS

Thermosetting mica paper glass cloth composite which cures to a semi-flexible state, for insulation of end windings, pole coils and connection.

### CALMICA-FLEX® SI 2726

Mica paper reinforced by aramid fibres impregnated with silicone resin and a glass cloth as carrier.

### CALMICA-FLEX® 0917

Mica paper impregnated with epoxy resin on a glass cloth as carrier.

## 4 SLOT / LAYER INSULATION

Flexible laminates used for slot insulation in traction motors or layer insulation in transformers.

### ISONOM NKN 3957

Mica filled Nomex and polyimide film showing LOI > 38%

### VOLTALEX GKG 2064

Glass fabric and polyimide film showing LOI > 50%

## 5 SPACERS & SUPPORTERS

### POROMAT® 2248

Swellable porous epoxy glass mat, both sides covered with PET fleece, as interlayer, spacer and filling material.

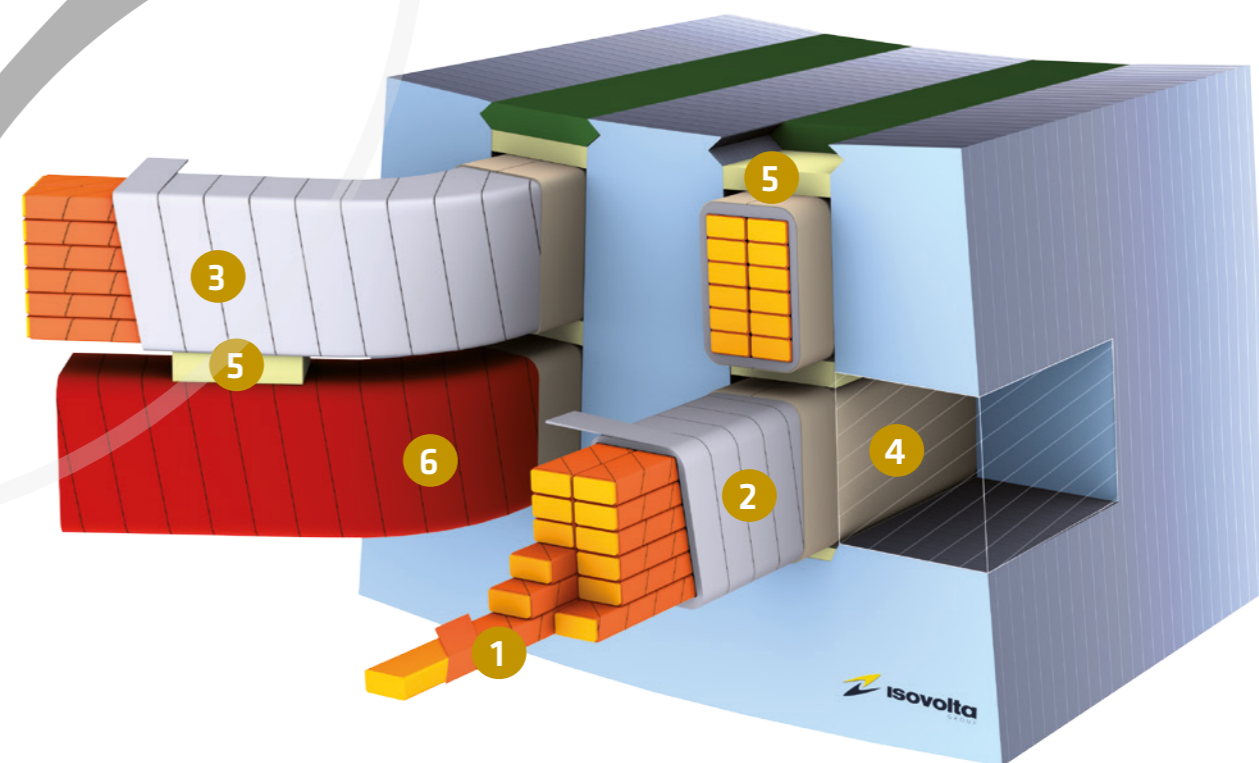
## 6 SEALING

### ISOSEAL® MF0611

Impregnated polyester/glass fabric combined with a thermo-shrinkable PET-film, used a top-sealing layer.



# FLEXIBLE INSULATION MATERIALS



Selection of flexible insulation materials depend strongly on the application and the requirements of the system.

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