



***P***ROFESSIONAL  
***P***RODUCTS *with*  
***P***ERFORMANCE



## **THE MATERIAL FOR THE 21st CENTURY**

Basalt is well known as a rock found in virtually every country round the world. Its main use is a crushed rock in construction, industrial and high way engineering. However, it is not commonly known that basalt can be used in manufacturing and made into fine, superfine and ultra fine fibres. Comprised of single-ingredient raw materials melt basalt fibres are superior to other fibres in terms of thermal stability, heat and sound insulation properties, vibration resistance and durability.

Basalt continuous fibres offer prospect of a completely new range of composite materials and products.

Basalt has no toxic reaction with air or water, is non-combustible and explosion proof. When in contact with other chemicals they produce no chemical reactions that may damage health or the environment. Basalt can replace almost all applications of asbestos and has three times its heat insulating properties. Basalt base composites can replace steel and known reinforced plastics (1 kg of basalt reinforcement equals 9,6 kg of steel). The life of basalt pipes, designed for a variety of applications is at least 50 years without maintenance or electric or technical protection.

Basalt fibres together with carbon or ceramic fibres as well as various metals is the most advanced and exciting area of application, as they can develop new hybrid composite materials and technologies.

Basalt special properties reduce the cost of products whilst improving their performance. More than hundreds specific unique manufacturing techniques using basalt fiber materials and products have been developed and patented in Russia.

### **BASALT-FIBER COMPOSITE, HYBRID MATERIALS AND ARTICLES**

- Thermal and sound insulation,
- Pipes for various purposes.
- Bars, fittings.
- Fabrics nets, prepregs.
- Structural plastics.
- Insulating plastics.
- Frictional materials.

# BASALT ROCK & BASALT FIBER

**Synonyms:** Basalt, black granite, traprock

## **Description:**

- The basalts are extrusive naturally mined igneous rock. They are dense fine-grained rocks that are of very dark color- green or black and form when molten lava from deep in the earth's crust rises up and solidifies.
- Slightly coarser old sheets of basalt, now partially altered but still dark in color, are extensively quarried, crushed, and sold as "traprock". Basalt is a hard, dense, dark volcanic rock composed chiefly of plagioclase, pyroxene, and olivine, and often having a glassy appearance.

## **Chemical Properties Available:**

- a) Plagioclase, and pyroxene
- b) The cut fibers are coated with a sizing treatment, which makes them highly compatible with epoxy and phenolic resins

## **Physical Properties Available:**

- a) Primarily sold as crushed pieces and cut or continuous fiber.
- b) Cut fiber length= 2 mm
- c) Cut fiber diameter= 9 microns

## **Nominal Characteristics:**

- High tensile strength
- Alkali resistant
- High thermal conductivity
- No carcinogenic risk or other health hazards
- Completely inert with no environmental risks
- Resistant to acids and aggressive chemicals
- High E modulus resulting in excellent specific tenacity, three times that of steel fiber
- Good fatigue resistance
- Electro-magnetic resistant

## **Nominal Physical Constants:**

Density (lbs.cu.ft.)	100 to 110
Tensile Strength (psi)	500k to 550k
Sintering Temperature (°C)	1050
Operating Temperature (°C)	- 265 to +600
Modulus of Elasticity (kg/mm <sup>3</sup> )	9100-1100
Creep	None
Mohs Hardness 20°C	5 to 9
Melting Point (deg. C)	1450
Heat Resistance (deg.C)	700-1,000
Elongation At Break (%)	3.15
Refractive Index	1.62
Elastic Modulus	89

### Typical Applications:

- Crushed stone, concrete aggregate, railroad ballast, production of high quality textile fibers, floor tiles, acid-resistant equipment for heavy industrial use, rockwool, basalt plastic pipes, basalt plastic reinforcement bars, basalt fiber roofing felt (ruberoid), basalt laminate used as a protective coating, heat-insulating basalt fiber materials, glass wool (fiber glass), etc.
- Basalt is the best reinforcement for concrete due to its tensile strength and natural resistance to deterioration from alkali
- Reinforcement for composites, polyester/epoxy resins and plastics as used in automotive body panels, boat hulls and pultruded products, etc.
- Friction materials such as brake pads and linings
- Manufacture of basalt mat/felt
- High-temperature insulation applications
- Passive fire protection materials
- Filler for gypsum and sheetrock board requiring increased 'burn-thru' capability, to meet building regulations
- High-performance automotive muffler filler

### Packaging:

Jars, pails, drums, multiply paper bags, bulk bags and fiberboard containers.

### **Fields of application:**

Electrical engineering. All simple and complex parts which need high dielectric properties.

Construction: Parts made of basalt-plastic resistance to the action of moisture, snow, temperature, and solar radiation, alkaline and acidic media.

Machine building, Parts or, blocks of machines operating under high temperatures or gas stream, For example the heat shield for a re-entering space vehicle.

Non-metallic fittings

The unique properties of long-lasting prepegs make possible to unboundedly use them depending on the user's requirements.

Completely incombustible thermal and sound insulation for cabins, motor compartments, metro carriages, ships and aircraft.

Electro technical and electronic circuit boards, brake pads for automobiles, aircraft, metro carriages and coaches.

Friction disks for auto tractor facilities.

Reinforcement for industrial rubber and other articles. and articles.

Belts for heavy-loaded conveyers

### **ENVIRONMENTAL SAFETY**

Protection screens against electromagnetic radiation and information read-out.

New generation body armour for individual and collective protection,

Fireproofing and heat protection working clothes

Containers for burial of extremely toxic waste,

Basalt-carbon heaters for clothes, rooms, incubators, etc.

## BASALT-PLASTIC PIPES

Basalt fibre composite pipes are obtained by winding basalt threads, fabrics, prepegs impregnated with a binder.

The pipes may be useful as components for shafts linings, building components, for transporting corrosive liquids and gases in the construction, industrial, agricultural and public services sectors. Other possible areas of application for basalt pipes are: masts, aerials frames various pipes in construction, communication, etc.

At present when the price difference between metal and composite pipes is becoming smaller and in view in substantial advantages of the composite pipes, the use of repair of old pipelines and construction of new ones is growing dramatically.

1. The weight of one meter of basalt-plastic pipes is 3 to 4 times less than the one of steel pipe. This is not only simplifies handling operations, but also essentially reduces cost for transporting load-lifting and installation work.
2. The strength of a plastic-plastic pipe is several times stronger than that of glass-fibre pipes and of the majority of steel-pipes. This quality of basalt-plastic makes it possible to create high pressure systems of higher reliability, i.e. over 1000 atm, which is not practically with metal pipes.
3. High chemical resistance to aggressive media makes it possible to manufacture pipelines for transporting hydrogen sulphide, acid alkalises etc.
4. And as a result of the above, there is no need for insulation and anti corrosion measures.
5. Basalt pipes are resistant to the action of fungi and micro organisms
6. Basalt-plastic has low thermal conductivity, thereby preventing the deposition of salts and paraffin's in pipelines and requiring no additional heat insulation.
7. Being insulators, basalt-plastic pipes are resistant to electrochemical corrosion. All this makes it possible to increase the guaranteed service life of basalt-plastic pipes to 60 – 80 years, i.e. 2 to 3 times as that of metallic ones.
8. The equipment intended for producing of fibreglass plastic pipes can be adapted to manufacture pipes of various diameters and wall thickness.

## LONG-LASTING BASALT PREPEGS

Long lasting prepegs are highly process able semi-products based on continuously or discrete basalt fibres impregnated with modified polyester (resin) for the production of various basalt-plastic products.

Long lasting prepegs have a long life (at least 4 years) under storage conditions sheltered premises hermetically packed at a temperature not over 40 °C.

The "FEBOTEX" prepegs is produced on basalt fabrics and is useful for processing to manufacture articles by winding laying-out followed by direct pressing autoclave and vacuum moulding.

The "FEBONITE" prepeg is produced based on discrete threads or fibres and it's useful for producing articles by transferee moulding and die-casting.

### Physical- chemical properties of long lasting prepegs

Binder	32 to 45 %
Volatiles	7 to 3 %
Binder soluble	85 to 8 %
Flow ability	3 to 25 %

## Physical-mechanical properties of basalt-plastics, based on long-lasting prepegs

Characteristics	Febotex	Febonite
Ultimate bending strength, MPa:	238,0	83.0
Bonding modulus, MPa x 10:	1.95	0,8
Ultimate compressive strength (along the reinforcement), MPa	86,0	126.0
Compressive modulus, MPa x 1 0	2.31	0.88
Ultimate tensile strength, MPa	302.0	23,0
Tensile; modulus, Mpa x10	2.10	0,8
Thermal conductivity, W (m x K)	0,26	0,25
Density, g/cm <sup>3</sup>	2,0	1,82
Bending strength, after heat treatment for 3.5 h (+850°C), MPa	75	
Volatile evolution under heating up to 350°C, %	10	
Volatile evolution under heating up to 850°C, %	15-20	

## REINFORCEMENT RODS

Rods of unidirectional basalt composite successfully replace metal reinforcement. At higher specific strength and resistance to aggressive media 1 kg of the basalt reinforcement replaces 9,6 kg of metallic.

They are used in production of building components, panels' barriers sidewalk, pavement and facing slabs, and many other structural components.

In view of their high electro insulation properties, basalt bars are used for making insulators for high voltage power lines.

An especially successful application of bars is for reinforcement of concrete slabs in hydraulic engineering and construction in seismically hazardous regions, in view of the fact that due to its chemical inertness the basalt reinforcement is compatible with concretes having different "pH", having actually the same coefficient of thermal expansion and no residual deformation under bending.

### Technical data

Density, g/cm <sup>3</sup>	1.95
Thermal conductivity, kcal/m x h x deg	0.3
Ultimate strength, Mpa:	
tensile	1200
compressive	420
bending	800
Mass fraction of polymer binder	20-to 25

## CONSTRUCTION

Reinforcement of bridges, tunnels.

Production of sandwich-panels based on basalt and carbon-basalt fibres

External] and internal heat and sound insulation.

Insulation of panel butt joints.

Directional and depressive reinforcement of concrete.

Repair (healing) of cracks, local damage to building&, bridges, building constructions,  
Soft roofing made of non-combustible baraltinsol and basaltoplastic  
Rigid roofing (of slate and tile type).  
Reusable shutters,  
Internal waste pipes  
Reinforced structures  
Heat-supply systems, cable conduits,  
Hydraulic construction.

### **ROAD CONSTRUCTION**

Reinforcement of concrete and asphalt pavements and runways.  
Construction of sound-absorbing barriers for highways, railways, and underground metro lines.  
Curbstones, pavement linings (basalt casting),  
Small moulds

### **ENGINEERING NETWORKS**

Pipelines for heating and hot, water supply.  
Pipelines for heat supply.  
Canalisation,  
Oil and gas pipelines  
Cable-conduit, telephone systems protected against electromagnetic fields and information leakage through electronic surveillance.  
Highly efficient seals and linings for pipelines.  
Pipes for chemical products and transportation of aggressive media.  
Pumps for aggressive media.

### **AGRICULTURE**

Land drainage pipes-  
Pipes for irrigation and hosing.  
Raising vegetable and seeding (hydroponics) Basalt super thin fibres.  
Agricultural construction,  
Agricultural machine construction.

### **UNDERGROUND CONSTRUCTION**

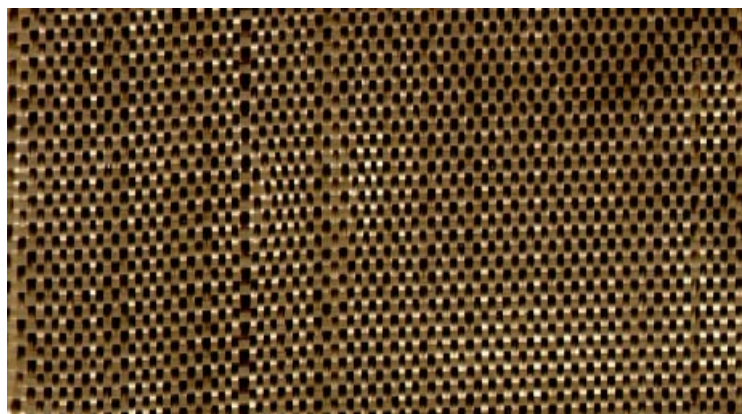
Anchors, pillars, ceilings vaults.  
Pipelines for various purposes.  
Foundations for building and constructions. less laying of pipelines.

### **MACHINE CONSTRUCTION**

Case and body parts.  
Thermo constant body containers  
Refrigerators.



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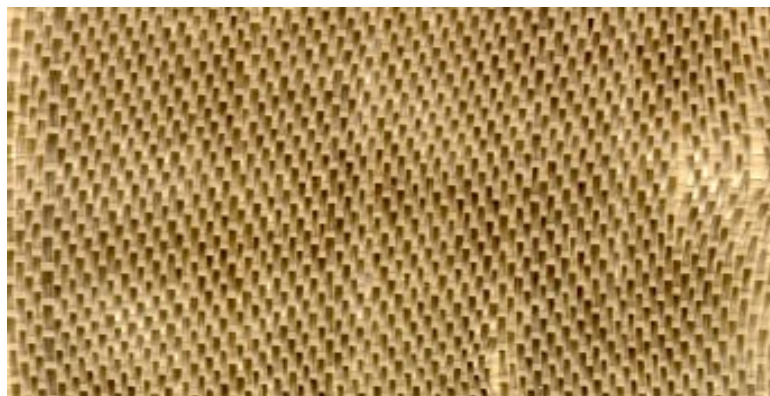
## **Basalt textile BAS-8**

### **Specification BAS-8**

Width, cm	100 +2 /-1 %
Thickness inmm	0,180+/-0,02
Surface density in g/m <sup>2</sup>	210+/-20
Density, threads/cm	
Warp	10 +1
Weft	8 +/-1
Breaking load N (kgf)	
Warp	931 (95)
Weft	882 (90)
Weave	Plain



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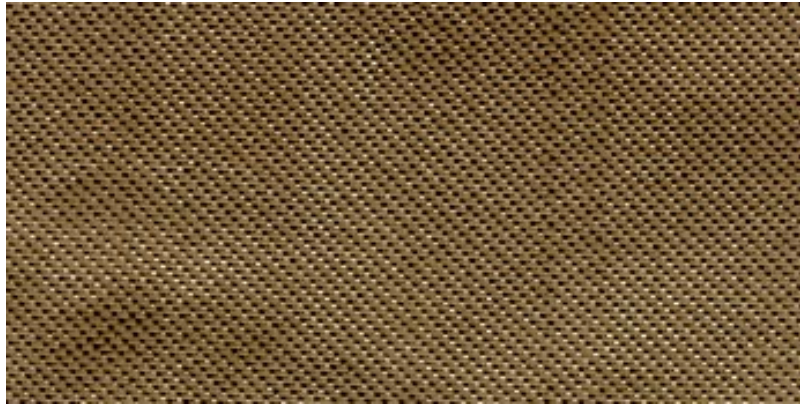
## **Basalt textile BAS-10**

### **Specification BAS-10**

Width	100 +2 /-1 %
Thickness in mm	0,17+/-0,02
Surface density in g/m <sup>2</sup>	225+/- 20
Density, threads/cm	
Warp	10 +1
Weft	12 +1
Breaking load N (kgf)	
Warp	931(95)
Weft	980 (100)
Weave	Satin 5/3



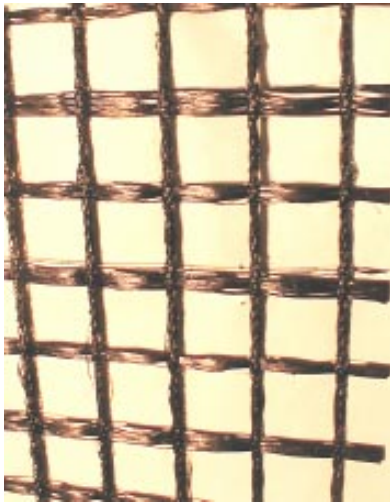
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## **Basalt textile BAS-11**

### **Specification BAS-11**

Width, cm	100 +2 /-1 %
Thickness in mm	0,27+/-0,03
Surface density in g/m <sup>2</sup>	345+/-25
Density, threads/cm	
Warp	22 +1
Weft	13 +1
Breaking load N (kgf)	
Warp	1715 (175)
Weft	980 (100)
Weave	Satin 5/3



## **Glasfibernet GLN for roads, run ways of airfields**

The net is intended for reinforcement of asphalt-concrete cover at building works, reconstruction and repair of high ways, run ways of airfields and other analogical road covers.

### **Specification net GLN**

Cell dimension (mesh) in mm	25 x 25
Width	100 + - 5
Width	200 + - 5
Count threads/m	
Warp	40 + - 2
Weft	40 + - 5
Surface density in g/m <sup>2</sup>	320 + - 40
Breaking load kN for 1 m nor less than	
Warp	45
Weft	40
Binder content in % not less than	

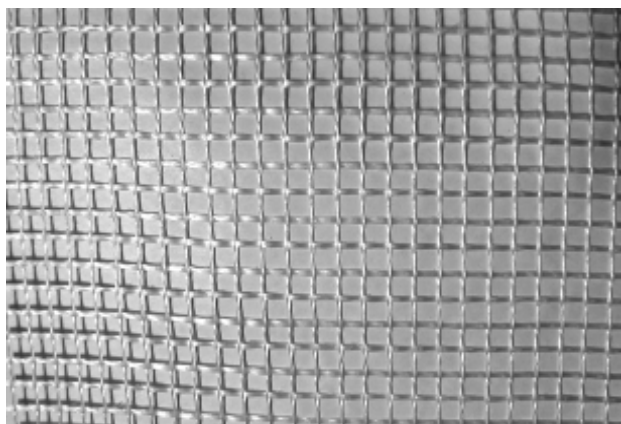
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## **Glas fiber net PFSS-5x5**

### **Specification net PFSS-5x5**

Cell dimension (mesh) in mm	5 x 5
Width	100 + 2 -1
Cont, threads/10 cm	
Warp	21+ -1
Weft	21 + -1
Surface density in g/m <sup>2</sup>	320 + - 40
Breaking load kN for 5 cm	
not less than	
Warp	1,0
Weft	1,0

## **BASALT FIBERS - ECOLOGICALLY SAFE MATERIALS AND ARTICLES BASED THEREON BASALT HEAT-INSULATING MATERIALS**

Basalt carpets, stitched mats, soft, semirigid and rigid boards and plates, cords - an energy-efficient vibration-resistant heat and sound insulation for:

- civil, agricultural, municipal, industrial building;
- engineering;
- aircraft engineering;
- automotive industry;
- ship building;
- insulating pipelines and thermal units, refrigerators and coolers, hydroponics.

### **PROPERTIES OF BASALT HEAT-INSULATING MATERIALS**

Density, kg/m <sup>3</sup>	20 - 450
Thermal conductivity, W/m*	0,027 - 0,05
Operating temperatures, °C	- 260 ....+ 700(900)
Normal sound absorption coefficient 260 to 2600 Hz	up to 0.99
Service life at least 70 years	

### **BASALT-PLASTICS PIPES INTENDED FOR:**

- transportation of petroleum and petroleum products, gases, aggressive liquids, loose materials;
- hot and cold water supply;
- cable-conduit systems;
- amelioration and irrigation.

Basalt-plastic pipes require no electrolytic protection, insofar as they are dielectrics, serve as a barrier for electromagnetic radiation and information read-out by inductive methods, are corrosion-proof, exhibit high wear as well as chemical and biological resistance.

### **PROPERTIES OF BASALT-PLASTIC PIPES**

Density, g/cm <sup>3</sup>	1,8 - 2,0
Diameter, mm	50 - 2000

#### **Ultimate strength, MPa**

tensile	>300
compressive	>250
bending	>230
Thermal conductivity, W/m*	0,2...0,3
Pressure, atm	0 - 250
Service life, years	60...100

A technology for laying and repair of basalt-plastic pipes has been developed.

### **LONG-LIFE PREPREGS INTENDED:**

- for obtaining via pressing of basalt-plastic articles, shells, pipes, panels, parts of complex configuration, etc.
- for repair and reinforcement of pipelines for heat, gas, oil mains in the field and under complicated environmental conditions; reinforcement of load-carrying constructions of buildings, bridges, vaults and supports of underground constructions.

The long-life prepregs are environmentally, chemically and biologically resistant. Technologies have been developed for all types of repair work using the long-life prepregs.

### **PROPERTIES OF LONG-LIFE PREPREGS**

Binder content, %	32 – 45
Volatiles content, %	7 +/- 3
Content of binder-soluble matter, %	85 +/- 8
Flowability, %	3 – 25

The prepreg useful life is 5 years from the date of output in case of storing in hermetically sealed packages at temperatures of any point of the Globe.

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## Technical characteristics of basalt

Dielectric permeability	5,0 to 5,5
Loss-angle tangent	0,01 3 to 0.01 8

### Technical characteristics of basalt-textolites

Surface resistance, Ohm	$1,0 \times 10^{12}$
After one hours heat exposure (125°C), 20% humidity	$1,0 \times 10^{11}$
Volume resistivity, Ohm/m	$4,0 \times 10^{10}$
After one hours heat exposure (125°C), 20% humidity	$6,0 \times 10,1$
Dielectric permeability	5,5
Loss-angle tangent after heat exposure for 90 hours, (40°C), 93 % humidity	0.020
Tear-off strength of the contact area H	120

### Comparative characteristics of asbestos and basalt fabrics

Characteristics	AT-1	BFS-1000
Width, mm	1040	1500
Thickness, mm	1,6 ,	1,6
Mass of 1 m <sup>3</sup> in g	1000	1000 + 10%
Number of threads per 100 min, warp/weft	80/40	80/40
Breaking load, kgf, warp/weft	65/30	250/200
Cachinnation losses, %	29	
Operating temperature, °C	130-400	up to 600

## Electro technical characteristics

Propertis	Indices
Volume resistance, Ohm x m	$4.0 \times 10^{11} - 6,0 \times 10^{12}$
Relative dielectric permeability (at 1 MHz)	1,8 ... 2,0
Density, g/cm <sup>3</sup>	2.7 to 3,0
Binder content, %	28 to 32

### Comparative characteristics of pipes for industrial water pipelines at 50 atm pressure (outer diameter 500 mm)

Characteristic of articles pipes	Seamless, pipes,	Welded pipes	Basalt plastic
	Tentative wall Thickness; is 10 mm.	Made of stainl. steel, Stell 12 x 18 HIOT Wall thickness is 5 mm	Wall thickness is 5 mm
Service life, years	3 to 7	30	to 90
Electrocorrosion	Yes	Yes	No
Thermal conductivity, arb. Units	200	200	
Hydraulic resistance (new/corroded)_	1.3/3.5	1,1/1,2	1/1
Weight of 1 run m, kg	128,24	65	15
Price of 1 run m, %	80	240	100
Labour Input, arb. units.	5-6	5-6	1-3

### Comparative characteristics of steel, glass-plastic and basalt pipes

Characteristic	Steel	Glass-plastic	Basalt-plastic
Ultimate tensile strength, Mpa	200	140	(300)*
Tensile modulus, GPa	210	56	70 (160)*
Density, kg/m <sup>3</sup>	7800	1900	1700
Thermal, conductivity,	47	0,5	0,3
Volume resistivity, ohm/m	Conductor	$1 \times 10^{10}$	$4 \times 10^{12}$

\*Note, In the brackets are values for pipe winding from hybrid basalt-carbon fibres. These properties indicates may be much higher.

**BASALTEX, a Line of Technical Textile Products of the Masureel Group Basaltex  
Products Line Fire Blocker 7101.40.10**

**Fire curtain**

**SPECIFICATIONS**

- 100% basalt satin weave 5/3 substrate with flame retarded protective coating -patent pending
- 375 gr/m<sup>2</sup>
- roll width 0,94 m
- fire resistance > 2 h improvement according to prEN 1364-1 dd. 1998/ ASTM E 119-98
- flame and mechanical integrity > 2 h
- good drapeability
- high flexibility
- high chemical, biological, radiation resistance
- fixing by sewing, staples, lamination
- breathable: air and vapour permeable

**APPLICATIONS**

Partitioning, fire flaps, outer layer of fire protective wrapping, cable conduits, sleeving, ...

**OPTIONS**

Weather resistant coatings, pigmented decorative topcoatings, reflective coatings, inumescent layer, water/oil repellent treatment, ...

**Fire Blocker 7101.40.10  
Fire barrier interliner for aviation**

**SPECIFICATIONS**

- 100% basalt plain weave substrate with flame retarded protective coating -patent pending-
- 245 gr/m<sup>2</sup>
- 0,94 m
- very high hazard conditions:
- resistance to ignitiuon with source 7 (crib 7) according to BS 6807 : 1996 section 2
- resistance to smouldering cigarette according to BS EN 597-1 : 1995
- resistance to match flamee according to BS EN 597-2 : 1995
- individual material flame retardant according to FAR 25.853
- low specific weight
- good drapeability
- high chemical, biological, radiation resistance
- fixing by sewing, staples, lamination
- breathable: air and vapour permeable

**APPLICATIONS**

seating and interior trim for aviation and very high hazard areas

**OPTIONS**

top coatings, water/oil repellent treatment, lamination,