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**THERMAL AND SOUND INSULATION  
AND FIRE PROTECTION FOR SHIPBUILDING**



CONTENT

JSC TIZOL is one of the recognized leaders among Russian manufacturers of non-combustible thermal and sound insulation materials and structural fire protection systems based on basalt. For shipbuilding and ship repair, our company produces products under the brand name TIZOL-FLOT.

For 70 years, our company has accumulated unique experience for the entire industry, created a technical and scientific base for training and work of highly qualified specialists. Continuous improvement of technology, modernization of production facilities, own raw materials base, accredited laboratory guarantee compliance of manufactured products with international quality standards.



Andrey Mikhailovich Mansurov  
General Director of JSC TIZOL

Technological capabilities make it possible to produce high-quality plate materials with a density from 25 to 200 kg/m<sup>3</sup> with different types of coatings, insulation of any configuration, including sets of various profiles, as well as cylinders for pipelines.

All TIZOL-FLOT products are approved by the Maritime Register of Shipping and the Russian Classification Society and are approved for use on Navy ships. Thermal insulation materials TIZOL-FLOT can be used for heat and sound insulation and fire protection of ship structures, insulation of engineering networks and creating comfortable indoor conditions.

TIZOL is the only Russian company that has European Module B certificates for ship insulation and fire protection structures, and supplies its products not only to domestic civil ships and warships, but also to the countries of the European Union and Southeast Asia.

Every year we produce 25 million square meters or 100 thousand tons of non-combustible heat and sound insulation and fire retardant materials. A well-developed dealer network ensures the timely delivery of our products to anywhere in the world. The company's specialists treat each partner with respect and create comfortable conditions for cooperation.

The TIZOL brand is development, stability, decency and, most importantly, quality.



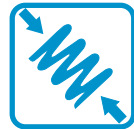
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## ADVANTAGES OF TIZOL-FLOT PRODUCTS



### FIRE PROTECTION

**TIZOL-FLOT** products are made from basalt fiber and belong to the group of non-combustible materials. Its application prevents the spread of flame through ship structures, which minimizes risks and increases the degree of fire protection.



### STRENGTH AND DURABILITY

**TIZOL-FLOT** products are resistant to aggressive environments and high temperatures, do not collapse under strong vibration loads, are not subject to rotting, and maintain the stability of geometric dimensions during operation.



### HIGH-QUALITY HEAT INSULATION

Due to the fibrous structure and the random arrangement of fibers, **TIZOL-FLOT** materials have a low thermal conductivity and high thermal insulation properties. The use of **TIZOL-FLOT** products contributes to the creation of a comfortable climate in ship premises.



### EFFICIENT SOUND INSULATION

Optimal density and fibrous structure give **TIZOL-FLOT** thermal insulation high sound-insulating properties. **TIZOL-FLOT** products absorb air, shock and structural noise well and provide sound insulation on sea and river vessels, creating an atmosphere of silence and comfort.



### VAPOR PERMEABILITY and HIGH MOISTURE RESISTANCE

**TIZOL - FLOT** products have high water-repellent properties and practically do not absorb moisture. Due to the high vapor permeability of **TIZOL-FLOT** products, excessive moisture in the premises can freely pass through the materials and evaporate from their surface without accumulating in the heat insulation thickness and without reducing its heat-protective properties.



### ENVIRONMENTAL SAFETY

**TIZOL-FLOT** products are made from natural raw materials: the basis is the rocks of the basalt group, and are absolutely safe for human health and the environment. The environmental safety of products is confirmed by the laboratory test reports of the Center for Hygiene and Epidemiology.



### MANUFACTURABILITY OF INSTALLATION

- Convenient packaging allows one or two people to move products inside the vessel
- The cutting is done both manually (knife, hacksaw blade) and with an electric tool (circular saw, electric jigsaw)
- Fastening of insulation is possible on welded pins or adhesive composition **PLAZAS**
- Ready-made sets for the insulation of stiffeners facilitate installation, allow you to speed up the process.

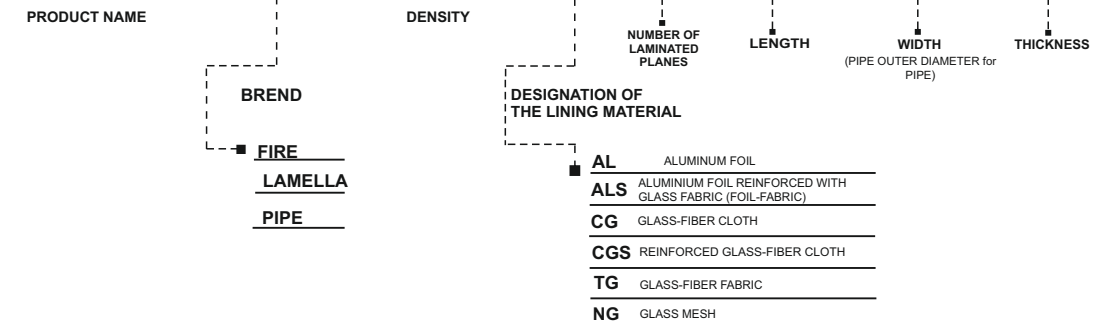


### AESTHETIC QUALITIES

The use of insulation with various coating materials gives the structure a finished look, does not require additional finishing.

## PURPOSE AND APPLICATION OF PRODUCTS «TIZOL-FLOT», «TIZOL-FLOT Fire», «TIZOL-FLOT Lamella», «TIZOL-FLOT Pipe»

### TIZOL-FLOT Fire 100/ AL 1 1000x 600x 50



Ship structures	Purpose	TIZOL-FLOT 30	TIZOL-FLOT 40	TIZOL-FLOT 50	TIZOL-FLOT 60	TIZOL-FLOT 80	TIZOL-FLOT 100	TIZOL-FLOT 120	TIZOL-FLOT 140	TIZOL-FLOT 150	TIZOL-FLOT 180	TIZOL-FLOT 200	TIZOL-FLOT Fire 50	TIZOL-FLOT Fire 80	TIZOL-FLOT Fire 100	TIZOL-FLOT Fire 150	TIZOL-FLOT Fire 200	TIZOL-FLOT Pipe 80	TIZOL-FLOT Pipe 100	TIZOL-FLOT Lamella 80	TIZOL-FLOT Lamella 150	TIZOL-FLOT Lamella 200
A-designs	fire insulation	●											●	●	●	●	●					
Case structures	thermal and sound insulation	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●			●	●	●
Floating floors	fire insulation																●	●				
Sandwich panels	thermal and sound insulation					●	●	●	●	●	●	●								●	●	●
Pipes	thermal and sound insulation								●	●								●	●			
Tanks	fire insulation												●	●	●	●	●					
	thermal and sound insulation	●	●	●	●	●	●	●	●	●	●	●	●	●	●			●	●			
Air ducts	thermal and sound insulation					●	●	●					●	●	●			●	●			
Chimneys	fire insulation												●	●	●							
	thermal and sound insulation					●	●	●	●	●	●	●	●	●	●	●	●	●	●			

Fastening of insulation to structures is carried out both on welded pins with subsequent fastening with spring washers, and on the adhesive composition PLAZAS TS 5772-014-08621635-2012

The adhesive composition PLAZAS, made on the basis of silicate binders, mineral fillers and modifying additives, has excellent adhesion to metal, concrete, wooden surfaces and basalt insulation materials belongs to the group of non-combustible materials, has certificates of approval of the Maritime Register of Shipping and the Russian Classification Society. The coating based on the adhesive composition is designed for operation at temperatures from minus 70°C to 800°C and humidity up to 98% both indoors and outdoors, while providing conditions that exclude the impact of atmospheric precipitation directly on the adhesive composition.



## BASIC TERMS AND PROPERTIES OF INSULATION

### STONE WOOL

Heat and sound insulating material made from the melt of igneous rocks. The main raw material for the production of stone wool fiber is gabbro-basalt rocks, therefore stone wool is often called basalt wool.

### INCOMBUSTIBILITY

Non—combustible materials are materials that do not ignite or burn under the influence of an ignition source (sparks, fire, high temperature).

### THERMAL CONDUCTIVITY

$\lambda = (W/(m \cdot K))$  The amount of heat that is transferred through a unit area ( $m^2$ ) of a layer of material one meter thick per unit time when the temperature changes by one degree. The value of thermal conductivity is influenced by the density of the material, type, size, location of pores, temperature of the material and its humidity.

### WATER ABSORPTION

The ability of a material or product to absorb and retain water in pores and capillaries. Water absorption worsens the properties of the material, increases thermal conductivity and average density, and reduces strength. It is measured in  $kg/m^2$ .

### HUMIDITY BY WEIGHT

The ratio of the mass of moisture contained in the material to the mass of the material itself in an absolutely dry state. It is expressed as a percentage.

### WATERPROOFING

Protection of building structures, buildings and constructions from the penetration of moisture and aqueous solutions of aggressive substances.

### WIND PROTECTION

Protection of heat-insulating material and internal structural elements of the outer walls of buildings from weathering and heat loss when air passes through an array of wool.

### SOUNDPROOFING

Reducing the energy of sound waves (reducing the noise level) penetrating the premises from the outside. The quantitative measure of sound insulation is expressed in decibels (RW, dB)

### SOUND ABSORPTION

The process of converting the energy of sound waves into other types of energy when sound propagates in a medium or when sound falls on the boundary of two media. The degree of sound absorption is determined by the ratio of the reflected sound energy to the absorbed. (Coefficient  $\alpha$ )

### VAPOR PERMEABILITY

The ability of a material to pass or retain steam as a result of the difference in partial pressure on the sides of the material. Vapor permeability determines the moisture transfer through the building envelope, which is one of the most significant factors in the heat transfer of the building envelope. It is characterized by an isothermal process of moisture transfer, determined by the gradient of water vapor elasticity.

### VAPOR BARRIER

A set of various methods for protecting heat-insulating materials from the penetration of steam and the absorption of condensate (dew).

### CHEMICAL RESISTANCE

The ability of a material to maintain its structure when exposed to various chemical agents. Neither oils, solvents, nor moderately acidic media have any effect on stone wool. Water infiltration from stone wool has a neutral chemical reaction, which means that the material does not cause corrosion on the contact surfaces.

### DENSITY

The characteristic of the material, determined by the ratio of the mass of the material to its volume ( $kg/m^3$ ).

### BIOLOGICAL SAFETY

Stone wool fibers are not a breeding ground for the reproduction of microorganisms and fungi, are not edible for rodents and insects. At the same time, mineral wool products are safe for humans and animals.

## INSULATION FOR SHIPBUILDING

JSC TIZOL offers a line of products for shipbuilding under the **TIZOL-FLOT** brand that meets all the requirements of the Technical Regulations of the Maritime Register of Shipping and the Russian Classification Society: heat-insulating mineral wool plates with a density of 30 to 200  $kg/m^3$  without coating, with various types of coating, designed to provide comfort, heat loss reduction, noise absorption, vibration damping and **TIZOL-FLOT Fire** plates with a density from 50 to 200  $kg/m^3$  for insulation of class A fire-fighting ship structures.

- Sets for insulation of stiffeners of various profiles (bulb flat, T-bar, L-bar) are cut from **TIZOL-FLOT** plates with a density of 50 to 150  $kg/m^3$  of the required dimensions, facilitating the installation process;
- **TIZOL-FLOT** Lamella of predetermined dimensions with a density of 80 to 200  $kg/m^3$  for space filling in marine sandwich panels in order to increase their strength and as sound insulation;
- **TIZOL-FLOT** Pipe technical insulation for pipes;
- cylinders, rolled materials from basalt fiber lined with fiberglass, foil or without it (basalt fire-retardant rolled material **MBOR** and stitched mats **MPB**) for insulating ship process equipment, pipelines, tanks, air ducts, etc.
- Coated products are used for car decks, engine rooms, ventilation and air conditioning systems, etc.
- foil coating provides additional protection against mechanical damage, moisture and other external factors. The heat-reflecting properties of the foil enhances the thermal insulation effect.
- coating with glass mesh and fiberglass cloth provides additional reinforcement of the surface of materials, which facilitates their installation and makes it possible to use less dense materials.
- coating with various fiberglass fabrics improves their dielectric properties, provides additional strength.

In terms of quality, the insulation is not inferior to foreign analogues, and in some respects even surpasses them. TIZOL-FLOT products have been approved by the Maritime Register of Shipping and the Russian Classification Society, Module B certificates (compliance with European standards with permission from the US Coast Guard) in Germany. TIZOL was the first Russian manufacturer of thermal insulation to start supplying shipbuilding products to Europe and Asia.



Materials and structures of JSC TIZOL have certificates of recognition of the Russian Classification Society, which gives the right to their use on vessels of inland and mixed (river-sea) navigation.



Materials and structures of JSC TIZOL have type approval certificates from the Russian Maritime Register of Shipping, which gives them the right to use them on sea vessels.

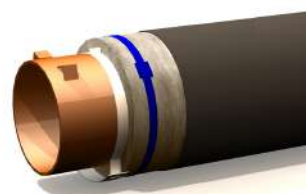
## TECHNICAL INSULATION



JSC TIZOL products for technical insulation in shipbuilding are a wide range of high-tech non-combustible heat and sound insulation materials made of basalt, designed for heat and sound insulation and fire protection of pipelines, air ducts, ventilation and air conditioning systems, process equipment.

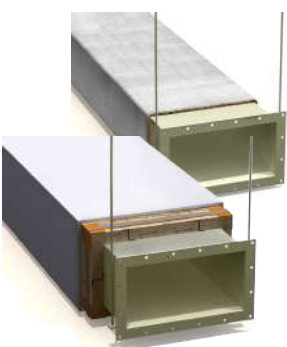
### Pipeline insulation

Pipelines are the most important technological part of any ship. To increase their productivity, it is necessary to reduce technological heat losses to a minimum. Thermal insulation of pipelines prevents heat loss in heating and water supply systems. The optimal solution for heat and sound insulation of pipelines for any purpose, which allows performing this task at minimal cost, are non-combustible **MBOR** basalt materials, **MPB** mats, **TIZOL-FLOT Pipe** cylinders, which additionally perform the functions of fire protection and sound insulation, protect the surface of the pipeline from corrosion and condensate.



### Duct insulation

Air ducts on ships are subject to increased requirements for fire safety, ensuring a constant temperature regime and the absence of condensate in the premises. Air duct insulation with **TIZOL-FLOT Pipe** cylinders (for round air ducts), **MBOR** materials, **MPB** mats (for air ducts of any cross section) maintains a constant temperature of the air flow, ensures the absence of moisture condensation on the ventilation ducts and significantly reduces the noise level from the operation of ventilation equipment, as well as protects the air duct from burning in case of fire.



### Equipment insulation

Additional heat and sound insulation and fire protection of high-temperature equipment, including those subject to vibration, with **TIZOL-FLOT** products can significantly reduce energy costs and ensure the necessary level of safety indoors during equipment operation.



## INSULATION FOR COMFORT

**TIZOL-FLOT** products are used for heat and sound insulation of light wall structures, bulkheads, decks, cabins, saloons and other ship spaces that require a high level of comfort.

### Indoor comfort is determined by:

- stable temperature of internal air;
- optimal relative humidity ;
- the most favorable acoustic regime.

### Heat Loss Reduction

Heating and air conditioning costs can be reduced by up to 70% through the use of high-quality thermal insulation. Thermal insulation products **TIZOL-FLOT** have a low coefficient of thermal conductivity and perfectly protect structures from heat loss.

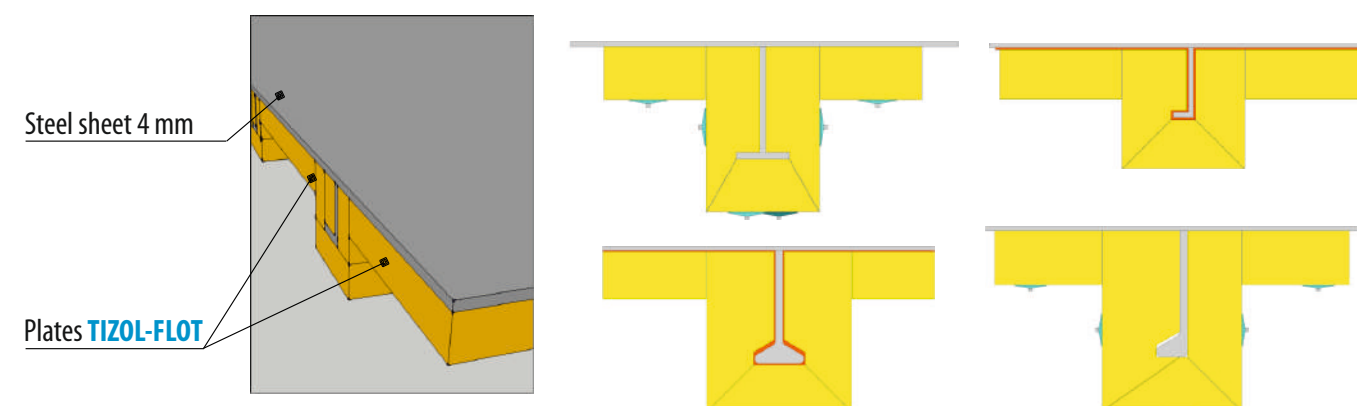
### Sound absorption

The advantage of **TIZOL-FLOT** products is that, along with excellent thermal insulation properties, it has high moisture resistance and excellent ability to absorb noise, reduce the level of impact and structural noise in the construction of floating floors, decks and bulkheads.

The efficiency of sound absorption by our materials is due to the presence in them of a large number of small open through pores with a large specific surface. The sound absorption index, depending on the thickness and density of the insulation, ranges from 0.6 to 1.0.

### Sound insulation

Due to their light fibrous structure and sufficient density, **TIZOL-FLOT** materials have enhanced soundproofing properties: they not only protect the structure, but also do not collapse from sound vibrations. The use of **TIZOL-FLOT** makes it possible to provide sound insulation between adjacent cabins, public spaces (salons, restaurants, etc.) and residential cabins.



## TIZOL-FLOT

TS 5762-015-08621635-2011

**TIZOL-FLOT** -- mineral wool heat and sound insulating plates.

**TIZOL-FLOT Fire** - stone wool plates for class A fire protection structures.

They are produced without lining and coated with foil, fiberglass mesh, fiberglass fabric, foil-fabric, fiberglass cloth (white and black), including reinforced.



**TIZOL-FLOT**  
**TIZOL-FLOT Fire**  
uncoated



**TIZOL-FLOT/AI1**  
**TIZOL-FLOT Fire/AI1**  
**TIZOL-FLOT/AIS1**  
**TIZOL-FLOT Fire/AIS1**  
coating: aluminum foil/foil, reinforced  
fiberglass (foil fabric)



**TIZOL-FLOT/TG1**  
**TIZOL-FLOT Fire/TG1**  
**TIZOL-FLOT/CGS1**  
**TIZOL-FLOT Fire/CGS1**  
coating: fiberglass  
fabric/reinforced fiberglass



**TIZOL-FLOT**  
**Lamella**

### Application:

**TIZOL-FLOT** - plates with a low coefficient of thermal conductivity, with a density of 30 to 200 kg/m<sup>3</sup> are used for thermal and sound insulation of hull structures, deckheads, ship premises of all types of sea and river vessels; are produced with a length of 1000 mm, a width of 500-600 mm, a thickness of 20 to 100 mm.

Application temperature from -180°C to +700°C.

**TIZOL-FLOT Fire** with a density of 50 and 100 kg/m<sup>3</sup> are used as insulation in fire-prevention structures (deck, bulkheads) of class A-30, A-60, as well as for heat and sound insulation of heat-generating equipment, chimneys and steel structures.

**TIZOL-FLOT Fire** with a density of 150 kg / m<sup>3</sup> are used as insulation in fire-resistant structures of a floating floor of class A-60.

**TIZOL-FLOT lamella** are cut to specified dimensions from **TIZOL-FLOT**, **TIZOL-FLOT Fire** plates of appropriate density (from 80 to 200 kg/m<sup>3</sup>) with a certain direction of the fibers to increase the rigidity of the structures. They are used as a filler in ship sandwich panels to provide fire protection, mechanical strength and sound insulation.

### PHYSICAL AND MECHANICAL PARAMETERS

Parameter name	Values for product brands	
	<b>TIZOL-FLOT</b>	<b>TIZOL-FLOT Fire</b>
Density, kg/m <sup>3</sup>	30 ÷ 200	50 ÷ 200
Thermal conductivity coefficient, W/(mK), no more, at temperature: (283±5)K (10±5)°C (298±5)K (25±5)°C (398±5)K (125±5)°C	0,034 ÷ 0,038 0,036 ÷ 0,040 0,050 ÷ 0,056	0,034 ÷ 0,038 0,037 ÷ 0,040 0,050 ÷ 0,058
Humidity, % by mass, no more	0,5	0,5
The content of organic matter. % by mass, no more	3,0 ÷ 4,0	3,0
Fire classification	non-combustible NC	

## TIZOL-FLOT Pipe

TS 5762-015-08621635-2011

**TIZOL-FLOT Pipe** - mineral wool heat and sound insulating cylinders with a wall thickness from 20 to 150 mm.

They are produced on special equipment without coating and with aluminum foil coating.



**TIZOL-FLOT Pipe**  
uncoated



**TIZOL-FLOT Pipe AI**  
coated with aluminum foil

### Application:

For heat and sound insulation of steam pipelines, technical pipelines and air ducts with a diameter from 12 mm to 1028 mm at an application temperature from -180°C to +700°C, on the surface of foil cylinders no more than 95°C.

### PHYSICAL AND MECHANICAL PARAMETERS

Parameter name	Values for product brands	
	<b>TIZOL-FLOT Pipe 80</b>	<b>TIZOL-FLOT Pipe 100</b>
Density, kg/m <sup>3</sup>	80±8	100±10
Thermal conductivity coefficient, W/(mK), no more, at temperature: (283±5)K (10±5)°C (298±5)K (25±5)°C (398±5)K (125±5)°C (573±5)K (300±5)°C	0,034 0,036 0,051 0,092	0,034 0,037 0,050 0,090
Humidity, % by mass, no more	0,5	0,5
The content of organic matter. % by mass, no more	4,0	4,0
Compressive strength at 10% deformation, kPa, not less	18,0	20,0
Fire classification	non-combustible NC	



## MBOR

### TS 5769-018-08621635-2013

**MBOR** - basalt fire-retardant rolled material - is a layer of cloth from basalt superthin fibers without a binder, stitched in a knitting-stitching method with a thickness of 5,8,10,13,16 mm.  
Available with or without coating material.



**MBOR**  
uncoated material



**MBOR-C1 , MBOR-C2**  
stitched with glass or basalt fabric on one or both sides



**MBOR-F**  
coated with aluminum foil on one side

#### Application:

Thermal and sound insulation of ship structures of pipelines, air ducts, ventilation systems, smoke extraction and air conditioning, (including to avoid condensation formation), as well as high-temperature equipment and structures of all types of river and sea vessels. It is used as a filter element in dry cleaning systems.

The application temperature is from  $-180^{\circ}\text{C}$  to  $+700^{\circ}\text{C}$ , on the foil surface no more than  $100^{\circ}\text{C}$ .

#### PHYSICAL AND MECHANICAL PARAMETERS

Parameter name	Values for product brands				
	MBOR-5	MBOR-8	MBOR-10	MBOR-13	MBOR-16
Density no more than, $\text{kg/m}^3$	100	100	100	120	120
Thermal conductivity coefficient, $\text{W/(mK)}$ , no more, at temperature : ( $298 \pm 5$ )K ( $25 \pm 5$ ) $^{\circ}\text{C}$ ( $398 \pm 5$ )K ( $125 \pm 5$ ) $^{\circ}\text{C}$ ( $573 \pm 5$ )K ( $300 \pm 5$ ) $^{\circ}\text{C}$	0,035 0,052 0,090				
Humidity, % by mass, no more	2				
Surface density, $\text{g/m}^2$ , no more*	500	800	1000	1600	1900
Fire classification	non-combustible NC				

\* Surface density on MBOR with coating material increases by 100-250  $\text{g/m}^2$ .

## MPB

### TS 5769-002-08621635-98 as amended 3

**MPB** - stitched mats made of basalt super-thin fiber with a density of 30-50  $\text{kg/m}^3$ .  
Available with or without coating material, thickness from 30 to 120 mm.



**MPB-30**  
without facing material



**MPB-30/KF1, MPB-30/CT1**  
coated with foil on one side or foil-cloth, fiber glass fabric



**MPB-30/CC1**  
coated with fiberglass mesh on one side



**MPB-50/CT2**  
coated with silica or fiberglass fabric on both sides



**MPB-50/BT2**  
coated with r fiberglass fabric on both sides

Application temperature from  $-180^{\circ}\text{C}$  to  $+700^{\circ}\text{C}$

At the request of consumers, it is possible to produce MPB-50 mats without lining and with lining on one side with a density of up to 50  $\text{kg/m}^3$ .

#### Application:

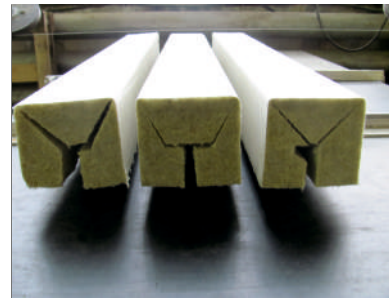
Heat and sound insulation of ship structures, equipment, air ducts and pipelines.

#### PHYSICAL AND MECHANICAL PARAMETERS

Parameter name	Values for product brands	
	MPB-30, MPB -30/KF1, MPB -30/F1, MPB -30/CT1/E3-200, MPB -30/CT1/T-13, MPB -30/CT1/T-23, MPB 30/KT1/KT-11, MPB -30/BT1LBK-100, MPB 30/CC1	MPB -50/CT2/E3-200, MPB -50/CT2/T-13, MPB -50/CT2/T23, MPB -50/KT2/KT-11, MPB 50/BT2LBK-100
Density, $\text{kg/m}^3$	25 - 40	41 - 60
Thermal conductivity coefficient, $\text{W/(mK)}$ , no more, at temperature : ( $298 \pm 5$ )K ( $25 \pm 5$ ) $^{\circ}\text{C}$ ( $398 \pm 5$ )K ( $125 \pm 5$ ) $^{\circ}\text{C}$ ( $573 \pm 5$ )K ( $300 \pm 5$ ) $^{\circ}\text{C}$	0,038 0,060 0,110	0,038 0,060 0,095
Humidity, % by mass, no more	2	
Mass fraction of chlorine ions, %, no more	0,03	
Compressibility, % by weight, no more	25	
Fire classification	non-combustible NC	

## SETS OF VARIOUS PROFILES

TS 5762-015-08621635-2011



They are produced in the form of reamers for insulating stiffeners of various profiles (L-bar, T-bar or bulb bar) of specified sizes from plates of the required density with various lining materials: fiberglass fabric, fiberglass cloth, aluminum foil and foil reinforced with fiberglass fabric (foil-fabric).

### Application:

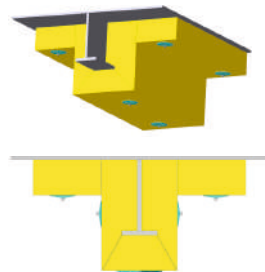
**SETS made of TIZOL-FLOT** with a density of 50 to 150 kg/m<sup>3</sup> are designed for heat and sound insulation of stiffeners of various profiles (L-bar, T-bar or bulb bar) of ship structures - decks, bulkheads, partitions. Application temperature on the insulation side is from -180°C to +700°C.

**SETS made of TIZOL-FLOT Fire** with a density of 50 to 150 kg/m<sup>3</sup> for insulation of stiffeners of various profiles (L-bar, T-bar or bulb bar) are applied in class A fire structures (deck, bulkheads).

A set of symmetrical laminated with foil fabric T-shaped profile with a foam thickness of 5 mm, foam size of 100 mm, shelf thickness of 8 mm, shelf size of 80 mm.. The thickness of the thermal insulation is 50 mm.

**TIZOL-FLOT Fire 100/AIS НУПТС 5x100/8x80-T50**

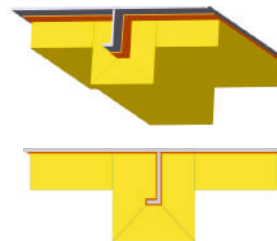
PRODUCT NAME designation of BRAND and COATING, sizes along the length of the set, ream perimeter and thickness in mm



A set of angle section node laminated with foil fabric with a shelf thickness of 3 mm, a shelf size of 100 mm and a second shelf thickness of 3 mm, a second shelf size of 40 mm. The thickness of the thermal insulation is 30 mm.

**TIZOL-FLOT 100/AIS НУПН 3x100/3x40-T30**

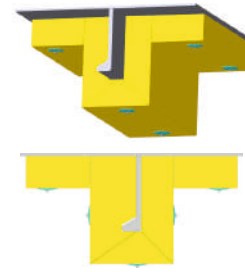
PRODUCT NAME designation of BRAND and COATING, sizes along the length of the set, ream perimeter and thickness in mm



A set of a bulb bar asymmetric node No. 8 laminated with foil. The thickness of the thermal insulation is 30 mm.

**TIZOL-FLOT 100 AL НУПН8-T30**

PRODUCT NAME designation of BRAND and COATING, sizes along the length of the set, ream perimeter and thickness in mm

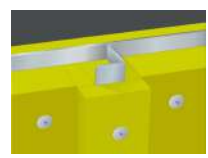
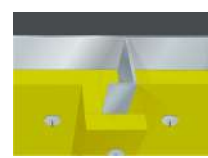
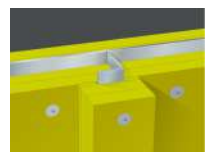
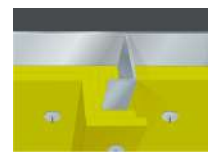


### PHYSICAL AND MECHANICAL PARAMETERS

Parameter name	TIZOL-FLOT	TIZOL-FLOT Fire
Density no more than, kg/m <sup>3</sup>	50-150	50-150
Thermal conductivity coefficient, W/(mK), no more, at temperature : (298±5)K (25±5)°C (398±5)K (125±5)°C (573±5)K (300±5)°C	0,034 ÷ 0,038 0,036 ÷ 0,040 0,050 ÷ 0,056	0,034 ÷ 0,038 0,037 ÷ 0,040 0,050 ÷ 0,058
Thickness, mm	20-100	25-100
Length, mm	1000±3	
Fire classification	non-combustible NC	
Type of coating	TG - fiberglass CG - fiberglass (black and white) AL - aluminum foil ALS - aluminum foil reinforced with fiberglass (foil fabric)	

## FIRE PROTETION STRUCTURES

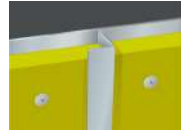



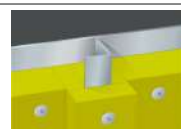
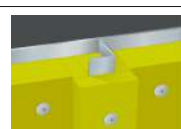




### Aluminum structures

Fire hazard class			Name (brand)		Thickness, mm	Density, kg/m <sup>3</sup>	Weight , kg/m <sup>2</sup>
A30	Bulkhead		Flat surface	TIZOL-FLOT Fire	30	100	3
			Set	TIZOL-FLOT Fire	30	100	3
A30	Deck		Flat surface	TIZOL-FLOT Fire	30	100	3
			Set	TIZOL-FLOT Fire	30	100	3
A60	Bulkhead		Flat surface	TIZOL-FLOT Fire	25	100	2,5
				TIZOL-FLOT Fire	25	100	2,5
			Set	TIZOL-FLOT Fire	25	100	2,5
				TIZOL-FLOT Fire	25	100	2,5
A60	Deck		Flat surface	TIZOL-FLOT Fire	25	100	2,5
				TIZOL-FLOT Fire	25	100	2,5
			Set	TIZOL-FLOT Fire	25	100	2,5
				TIZOL-FLOT Fire	25	100	2,5







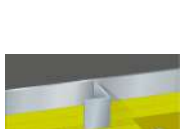


## FIRE PROTECTION STRUCTURES

### Steel structures

Fire hazard class			Name (brand)		Thickness, mm	Density, kg/m <sup>3</sup>	Weight, kg/m <sup>2</sup>
A15	Bulkhead		Flat surface	TIZOL-FLOT Fire	40	50	2
			Set	Not insulated			
A30	Bulkhead		Flat surface	TIZOL-FLOT Fire	30	100	3
			Set	TIZOL-FLOT Fire	30	100	3
A30	Bulkhead		Flat surface	TIZOL-FLOT Fire	30	100	3
			Set	TIZOL-FLOT Fire	30	100	3
A60	Bulkhead		Flat surface	TIZOL-FLOT Fire	80	50	4
			Set	TIZOL-FLOT Fire	20	100	2
A60	Bulkhead		Flat surface	TIZOL-FLOT Fire	60	100	6
			Set	TIZOL-FLOT Fire	25	100	2,5
A60	Bulkhead		Flat surface	TIZOL-FLOT Fire	40	100	4
			Set	TIZOL-FLOT Fire	25	100	2,5
A60	Bulkhead		Flat surface	TIZOL-FLOT Fire	40	100	4
			Set	TIZOL-FLOT Fire	40	100	4
A60	Bulkhead		Flat surface	TIZOL-FLOT Fire	60	100	6
			Set				
A60	Bulkhead		Flat surface	TIZOL-FLOT Fire	25	100	2,5
				TIZOL-FLOT Fire	25	100	2,5
			Set	TIZOL-FLOT Fire	25	100	2,5
H60	Bulkhead		Flat surface	TIZOL-FLOT Fire	40	150	6
				TIZOL-FLOT Fire	40	150	6
			Set	TIZOL-FLOT Fire	40	150	6
				TIZOL-FLOT Fire	40	150	6

## FIRE PROTECTION STRUCTURES

### Steel structures

Fire hazard class			Name (brand)		Thickness, mm	Density, kg/m <sup>3</sup>	Weight, kg/m <sup>2</sup>
A15	Deck		Flat surface	TIZOL-FLOT Fire	40	50	2
			Set	Not insulated			
A30	Deck		Flat surface	TIZOL-FLOT Fire	25	100	2,5
			Set	TIZOL-FLOT Fire	25	100	2,5
A60	Deck		Flat surface	TIZOL-FLOT Fire	60	50	3
			Set	TIZOL-FLOT Fire	20	100	2
A60	Deck		Flat surface	TIZOL-FLOT Fire	25	100	2,5
				TIZOL-FLOT Fire	25	100	2,5
			Set	TIZOL-FLOT Fire	25	100	2,5
A60	Deck		Flat surface	TIZOL-FLOT Fire	40	100	4
			Set	TIZOL-FLOT Fire	25	100	2,5
H60	Deck		Flat surface	TIZOL-FLOT Fire	40	150	6
				TIZOL-FLOT Fire	40	150	6
			Set	TIZOL-FLOT Fire	40	150	6
				TIZOL-FLOT Fire	40	150	6
A60	Floating floor			TIZOL-FLOT Fire	25	150	3,75
				TIZOL-FLOT Fire	25	150	3,75

## MATERIAL SPECIFICATIONS

### Thermal insulation of hull structures with TIZOL-FLOT plates

Grade of insulation material	Coefficient of thermal conductivity $\lambda_{10^\circ\text{C}/\lambda_{25^\circ\text{C}} \text{ W/(mK)}$	Density $\text{kg/m}^3$	Length $\text{mm}$	Plate width $\text{mm}$	Plate thickness, $\text{mm}$	Plate area, $\text{m}^2$	Plate volume, $\text{m}^3$	Air noise insulation index (single-wall construction with a sheet metal thickness of 4 mm), $R_w$ , dB	Air noise insulation index (double-walled structure with a sheet metal thickness of 2 mm), $R_w$ , dB	Sound absorption index, $\alpha_w$
TIZOL-FLOT 30	0,037 / 0,04	30	1000	500 / 600	50	0,50 / 0,60	0,025 / 0,030	—	48	—
					60	0,50 / 0,60	0,030 / 0,036		49	
					70	0,50 / 0,60	0,035 / 0,042		50	
					80	0,50 / 0,60	0,040 / 0,048		52	
					90	0,50 / 0,60	0,045 / 0,054		54	
					100	0,50 / 0,60	0,050 / 0,060		55	
TIZOL-FLOT 40	0,036 / 0,038	40	1000	500 / 600	30	0,50 / 0,60	0,015 / 0,018	—	47	0,60
					40	0,50 / 0,60	0,020 / 0,024		47	0,65
					50	0,50 / 0,60	0,025 / 0,030		48	0,70
					60	0,50 / 0,60	0,030 / 0,036		49	0,75
					70	0,50 / 0,60	0,035 / 0,042		50	0,80
					80	0,50 / 0,60	0,040 / 0,048		52	0,83
TIZOL-FLOT 50	0,035 / 0,038	50	1000	500 / 600	30	0,50 / 0,60	0,015 / 0,018	—	47	0,60
					40	0,50 / 0,60	0,020 / 0,024		47	0,62
					50	0,50 / 0,60	0,025 / 0,030		48	0,65
					60	0,50 / 0,60	0,030 / 0,036		49	0,73
					70	0,50 / 0,60	0,035 / 0,042		50	0,80
					80	0,50 / 0,60	0,040 / 0,048		52	0,84
TIZOL-FLOT 60	0,035 / 0,038	60	1000	500 / 600	30	0,50 / 0,60	0,015 / 0,018	—	47	0,60
					40	0,50 / 0,60	0,020 / 0,024		47	0,65
					50	0,50 / 0,60	0,025 / 0,030		48	0,70
					60	0,50 / 0,60	0,030 / 0,036		49	0,80
					70	0,50 / 0,60	0,035 / 0,042		50	0,85
					80	0,50 / 0,60	0,040 / 0,048		52	0,90
TIZOL-FLOT 80	0,034 / 0,036	80	1000	500 / 600	30	0,50 / 0,60	0,015 / 0,018	—	48	0,70
					40	0,50 / 0,60	0,020 / 0,024		49	0,80
					50	0,50 / 0,60	0,025 / 0,030		50	0,90
					60	0,50 / 0,60	0,030 / 0,036		51	0,92
					70	0,50 / 0,60	0,035 / 0,042		52	0,93
					80	0,50 / 0,60	0,040 / 0,048		53	0,95
TIZOL-FLOT 100	0,034 / 0,037	100	1000	500 / 600	30	0,50 / 0,60	0,015 / 0,018	—	48	0,70
					40	0,50 / 0,60	0,020 / 0,024		49	0,80
					50	0,50 / 0,60	0,025 / 0,030		50	0,90
					60	0,50 / 0,60	0,030 / 0,036		51	0,92
					70	0,50 / 0,60	0,035 / 0,042		52	0,93
					80	0,50 / 0,60	0,040 / 0,048		53	0,95

### Fire insulation of ship structures by plates TIZOL-FLOT Fire

Grade of insulation material	Density, $\text{kg/m}^3$	Plate length, $\text{mm}$	Plate width, $\text{mm}$	Plate thickness, $\text{mm}$	Plate area, $\text{m}^2$	Plate volume, $\text{m}^3$	Insulation weight per $\text{m}^2$	Number of fasteners pcs. per $\text{m}^2$	Weight of fasteners per $\text{m}^2$	Thermal conductivity coefficient $\lambda_{10^\circ\text{C}/\lambda_{25^\circ\text{C}} \text{ W/(mK)}$	Sound absorption index, $\alpha_w$	Air noise insulation index (single-wall construction with a thickness of 4mm metal sheet) $R_w$ , dB
TIZOL-FLOT Fire 50	50	1000	500 / 600	25x2	0,50 / 0,60	0,025 / 0,030	2,50	9	0,070	0,035 / 0,038	0,65	41
TIZOL-FLOT Fire 100	100	1000	500 / 600	25x2	0,50 / 0,60	0,025 / 0,030	5,00	9	0,070	0,034 / 0,037	0,90	42
TIZOL-FLOT Fire 150	150	1000	500 / 600	25x2	0,50 / 0,60	0,025 / 0,030	7,50	9	0,070	0,035 / 0,038	0,75	43
TIZOL-FLOT Fire 200	200	1000	500 / 600	25x2	0,50 / 0,60	0,025 / 0,030	10,00	9	0,070	0,038 / 0,040	0,70	44

## MATERIAL SPECIFICATIONS

### Thermal insulation of panels with TIZOL-FLOT Lamella material

Grade of insulation material	Density, $\text{kg/m}^3$	Lamella length, $\text{mm}$	Lamella width, $\text{mm}$	Lamella thickness, $\text{mm}$	Thermal conductivity coefficient $\lambda_{10^\circ\text{C}/\lambda_{25^\circ\text{C}} \text{ W/(mK)}$	Lamella area, $\text{m}^2$	Lamella volume, $\text{m}^3$	Insulation weight per $\text{m}^2$ , $\text{kg}$
TIZOL-FLOT Lamella 80	80	1000	100	16,0	0,038 / 0,040	0,10	0,0016	1,28
				23,5		0,10	0,0024	1,88
				29,0		0,10	0,0029	2,32
				39,0		0,10	0,0039	3,12
				41,0		0,10	0,0041	3,28
				49,0		0,10	0,0049	3,92
TIZOL-FLOT Lamella 150	150	1000	100	16,0	0,042 / 0,044	0,10	0,0016	2,40
				23,5		0,10	0,0024	3,53
				29,0		0,10	0,0029	4,35
				39,0		0,10	0,0039	5,85
				41,0		0,10	0,0041	6,15
				49,0		0,10	0,0049	7,35
TIZOL-FLOT Lamella 200	200	1000	84/100	16,0	0,044 / 0,046	0,084	0,0013	3,10
				23,5		0,084	0,0020	4,52
				29,0		0,084	0,0024	5,71
				39,0		0,084	0,0032	7,62
				41,0		0,084	0,0034	8,10
				49,0		0,084	0,0041	9,76

### Thermal insulation of ship equipment with rolled material MBOR

Grade of insulation material	Length, mm	Length, mm	Width, mm	Insulation weight per 1 m <sup>2</sup> , no more than, kg	Number of fasteners, pcs. per 1 m <sup>2</sup>	Weight of fasteners per 1 m <sup>2</sup>	Thermal conductivity coefficient λ10°C/λ 25°C, W/(mK)	Sound absorption index, αw	Air noise insulation index (single-wall construction with 0.8 mm sheet metal thickness), Rw, dB
MBOR-5	30000	1500	5	0,50	9		0,033 / 0,035	0,40	28
MBOR-8	20000	1500	8	0,80	9			0,45	29
MBOR-10	16000	1500	10	1,00	9			0,50	29
MBOR-13	10000	1500	13	1,60	9			0,50	29
MBOR-16	10000	1500	16	1,90	9			0,50	30
MBOR-5F	30000	1500	5	0,60	9	0,70	0,033 / 0,035	0,15	29
MBOR-8F	20000	1500	8	0,90	9			0,25	30
MBOR-10F	16000	1500	10	1,10	9			0,30	30
MBOR-13F	10000	1500	13	1,70	9			0,30	31
MBOR-16F	10000	1500	16	2,00	9			0,35	31
MBOR-C-5	30000	1500	5	0,63	9		0,033 / 0,035	0,35	28
MBOR-C-8	20000	1500	8	0,90	9			0,45	29
MBOR-C-10	16000	1500	10	1,25	9			0,50	29
MBOR-C-13	10000	1500	13	1,73	9			0,50	29
MBOR-C-16	10000	1500	16	2,03	9			0,50	30

### Thermal insulation of ship structures with MPB mats

Grade of insulation material	Density, kg/m <sup>3</sup>	Mat length, mm	Mat width, mm	Mat thickness, mm	Thermal conductivity coefficient λ10°C/λ 25°C, W/(mK)	Mat area, m <sup>2</sup>	Mat volume, m3	Protective shell insulation			Sound absorption index , αw
								Insulation weight per 1 m <sup>2</sup> , depending on the type of coating			
								Uncoated	Fiberglass fabric coating	Foil coating	
MPB-30	30	1500	500	30	0,032 / 0,034	0,75	0,023	0,90	—	1,05	1
				40		0,75	0,030	1,20	—	1,35	1
				50		0,75	0,038	1,50	—	1,65	1
				60		0,75	0,045	1,80	—	1,95	1
				70		0,75	0,053	2,10	—	2,25	1
				MPB-30		50	1500	500	30	0,75	0,023
40	0,75	0,030	2,00	2,68	—				1		
50	0,75	0,038	2,50	3,18	—				1		
60	0,75	0,045	3,00	3,68	—				—		
70	0,75	0,053	3,50	4,18	—				—		