

Insulation for shipbuilding

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"TIZOL-FLOT" IN MARINE AND RIVER CRAFTS



CONTENT

- "TIZOL-FLOT" on sea and river crafts 2-23
- Opening address of the General Director of JSC "TIZOL" 4
- About the plant "TIZOL" 5
- Advantages of TIZOL-FLOT products 6
- Basic terms and properties of insulation 7
- Insulation for shipbuilding 8
- Technical insulation 9
- «TIZOL-FLOT» 10
- «TIZOL-FLOT Pipe» 11
- Basalt Fireproof rolled material (MBOR) 12
- Basalt pierced mats (MPB) 13
- Sets of various profiles 14
- Insulation for comfort 15
- Fireproof structures 16-18
- Purpose and application of insulation "TIZOL-FLOT» 19
- Material specifications 20-21
- The representatives of "TIZOL-FLOT» 22



Mikhail Grigoryevich Mansurov
General Director of JSC "TIZOL", Honored Builder,
Honorary freeman of the town of Nizhnyaya Tura

TIZOL JSC is one of the recognized leaders among Russian manufacturers of non-combustible heat and sound insulating materials and systems of constructive fire protection based on basalt, including products for shipbuilding manufactured under the brand name TIZOL-FLOT.

For 70 years, our company has accumulated a unique experience for the entire industry, has created a technical and scientific base for training and work of highly qualified specialists. Continuous improvement of technology, modernization of production facilities, its own raw material base, an accredited laboratory guarantee the compliance of manufactured products with international quality standards. Technological capabilities allow producing high-quality plate materials with a density from 25 to 200 kg / m³ with different types of coatings, insulation of any configuration, including sets of various profiles, as well as cylinders for pipelines.

All products for shipbuilding are approved by the Maritime and River Register of Shipping and approved for use on Navy ships.

Thermal insulation materials of JSC "TIZOL" can be used for heat and sound insulation and fire protection of ship structures, comfort of premises and insulation of engineering networks.

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

Today TIZOL-FLOT products are successfully used both in civil and military projects.

Every year we produce 25 million square meters or 100 thousand tons of non-combustible heat and sound insulation and fire-proof materials.

The developed dealer network ensures timely delivery of our products anywhere in the world. Specialists of the company treat each partner with respect and create comfortable conditions for cooperation.

Brand «TIZOL» is development, stability, integrity and, that is the most important, quality.



TIZOL®



ABOUT THE PLANT "TIZOL"

RELIABILITY

The enterprise was founded in 1949 to provide non-combustible, heat-insulating materials to nuclear industry facilities. Accumulated professional experience has enabled us to gain a reputation as a reliable and stable partner.



QUALITY

The accredited laboratory carries out a comprehensive analysis at all stages of production: control of raw materials, technological processes and parameters of the finished product. The quality management system of JSC "TIZOL" is recognized as complying with the requirements of the international standard ISO 9001: 2015 and Module D.



PARTNERSHIP

"TIZOL" always meets its partners' and clients' needs. Using the method of personal sales, constant communication with consumers, participation in exhibitions, seminars and practical conferences allows us to respond quickly to market changes and improve the properties of products.



ENVIRONMENTAL FRIENDLINESS

"TIZOL" company pays great attention to the environmental safety of its production. In recent years, the company has carried out capital-intensive environmental measures, which has dramatically reduced the negative impact on the environment.



INNOVATIONS

"TIZOL" is one of the leading enterprises in Russia for the production of building, technical and fire insulation based on basalt fiber. A new direction in the development of the company is the production of high-quality heat and sound insulation for shipbuilding under the brand "TIZOL-FLOT", which meets all the requirements of the Marine and River Registers. The plant's products are used on civilian ships and on surface ships of the navy, including corvettes and patrol boats. The corvette "Stereushchy" became the "first sign" among them.



RECOGNITION

"TIZOL" was the first Russian company manufacturing thermal insulation that received the certificate Module D (Production Quality Assurance) of the Council of the European Society Directive 2014/90 / EU for ship equipment that guarantees the quality of production to meet international standards and it delivers products to Germany, China and the Middle East.

ADVANTAGES OF TIZOL-FLOT PRODUCTS



FIRE PROTECTION

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



QUALITATIVE THERMAL INSULATION

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



VAPOUR 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, excess moisture in the rooms can freely pass through the materials and evaporate from their surface without accumulating in the thickness of the insulation and without reducing its heat-shielding properties.



TECHNOLOGICAL EFFECTIVENESS OF INSTALLATION

- Convenient packaging allows one or two people to move products to inside the ship.
- Cutting is done both manually (knife, hacksaw blade) and with power tools (circular saw, jigsaw).
- Fastening of insulation is possible on welded pins or adhesive compound "PLAZAS".
- Ready sets for insulation of stiffening ribs facilitate installation, allow accelerating process.



STRENGTH and DURABILITY

TIZOL-FLOT products are resistant to aggressive media and high temperatures, do not collapse under strong vibration loads, are not subject to rotting, and retain their dimensional stability during operation.



EFFICIENT SOUND INSULATION

Optimal density and fibrous structure give thermal insulation **TIZOL-FLOT** high sound insulation properties. Products **TIZOL-FLOT** well absorbs air, shock and structural noise and provides sound insulation on sea and river crafts, creating an atmosphere of peace and comfort.



ENVIRONMENTAL SAFETY

TIZOL-FLOT products are made from natural raw materials: the basalt rocks are the basis, 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.



AESTHETIC QUALITIES

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

MAIN TERMS AND PROPERTIES OF INSULATION

STONE WOOL

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

INCOMBUSTIBILITY

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

THERMAL CONDUCTIVITY

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

WATER ABSORPTION

It is an 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, reduces strength. It is measured in kg/m^2 .

MASS HUMIDITY

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

WATERPROOFING

This is the protection of building structures, buildings and structures from the penetration of moisture and aqueous solutions of aggressive substances.

WIND PROTECTION

This is the protection of thermal insulation material and internal structural elements of the outer walls of buildings from weathering and heat loss when air passes through the array of wool.

SOUND INSULATION

This is a decrease in the energy of sound waves (noise reduction) penetrating into the premises from the outside. The quantitative measure of sound insulation is expressed in decibels. (RW, dB)

SOUND ABSORPTION

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

VAPOR PERMEABILITY

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

VAPOR BARRIER

It is a combination of various methods of protecting thermal insulation materials from vapor penetration and absorption of condensate (dew).

CHEMICAL RESISTANCE

It is an ability of a material to maintain its structure when exposed to various chemical agents. No oils, solvents or moderately acidic media have any effect on the stone wool. The infiltration of rock wool water has a neutral chemical reaction, which means that the material does not cause corrosion on the contact surfaces.

DENSITY

This is a 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; they are not edible for rodents and insects. At the same time, mineral wool products are safe for people and animals.

INSULATION FOR SHIPBUILDING

JSC "TIZOL" offers a range of products for shipbuilding under the brand name **TIZOL-FLOT**, which meets all the requirements of Technical regulations of Marine and River registers: mineral wool insulation plates with a density from 30 to 200 kg/m³, uncoated, with different types of coatings designed to provide comfort, reduce heat loss, noise absorption, vibration damping and plates **TIZOL-FLOT Fire** with a density from 50 to 200 kg/m³ for the insulation of fire-fighting ship structures of class A.

- Sets for insulation of stiffening ribs of various profile (bulb flat, T-bar, angle bar), are cut out from **TIZOL-FLOT** plates with density from 50 to 150 kg/m³ of the required sizes, facilitating installation process.
 - **TIZOL-FLOT Lamella** of specified dimensions with a density from 80 to 200 kg/m³ to fill the space in the ship sandwich panels in order to increase their strength and as sound insulation.
 - **TIZOL-FLOT Pipe** technical is an insulation for pipes; cylinders, rolled materials from basalt fiber coated with fiberglass, with or without foil (basalt fireproof rolled material MBOR and pierced mats MPB) for insulating of marine technological equipment, pipelines, tanks, 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 enhance the heat-insulating effect.
 - coating with fiberglass mesh and fiberglass cloth provides additional reinforcement of the surface of the materials, which facilitates their installation and makes it possible to use less dense materials.
 - coating with various glass fabrics improves their dielectric properties and provides additional strength.

The quality of insulation is not inferior to foreign counterparts, and surpasses them in some parameters.

TIZOL-FLOT products have received approvals of the Maritime and River Registers, certificates of Module B (compliance with European standards with the permission of the US Coast Guard) in Germany.

TIZOL is the first Russian manufacturer of thermal insulation that delivers products for shipbuilding to countries in Europe and Asia.

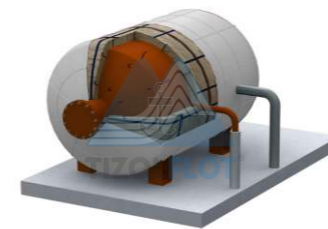


Materials and structures JSC "TIZOL" have certificates of approval of the Russian River Register, which gives the right to use them on ships of inland and mixed (river-sea) navigation.



Materials and structures JSC TIZOL has Certificates on standard approval by the Russian Maritime register of shipping that grants the right to apply them on sea crafts.

TECHNICAL INSULATION

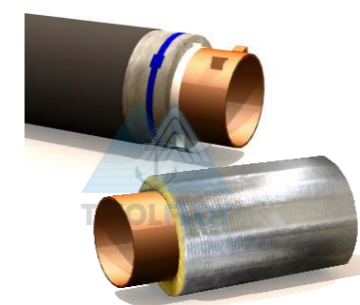


JSC "TIZOL" products for technical insulation in shipbuilding are a wide range of high-tech non-combustible heat and sound insulating materials made of basalt, intended for heat and sound insulation and fire protection of pipelines, air ducts, ventilation and air conditioning systems, and process equipment.

Pipeline insulation

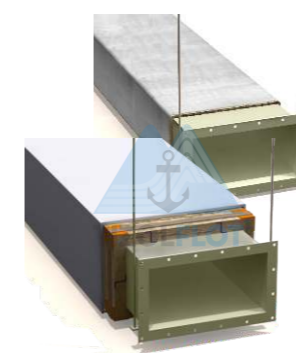
Pipelines are the most important technological part of any vessel. To increase their productivity, it is necessary to reduce technological heat losses to a minimum. Thermal insulation of pipelines prevents heat loss in heating and water supply systems.

Non-combustible basalt materials **MBOR**, **MPB** mats, cylinders **TIZOL-FLOT Pipe**, which additionally perform fire protection and sound insulation functions, protect the surface of the pipeline from corrosion and condensate, are the optimal solution for heat and sound insulation of pipelines of any designation, allowing to perform this task with minimal cost.



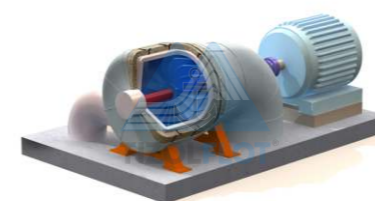
Air ducts insulation

The structures of air ducts on ships are subject to increased requirements for fire safety, ensuring constant temperature and the absence of condensate in the premises. Insulation of the air duct by **TIZOL-FLOT Pipe** cylinders (for circular ducts), **MBOR** materials, **MPB** mats (for air ducts of any section) maintains a constant temperature of the air flow, ensures the absence of condensation of moisture on the ventilation ducts and significantly reduces the noise level from the 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 consumption and ensure the necessary level of safety in the room during operation of the equipment.



TIZOL-FLOT

TU 5762-015-08621635-2011

TIZOL-FLOT - mineral wool heat and sound insulation plates.

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

They are produced without covering and covered with foil, fiberglass mesh, fiber glass fabric, folma-fabric, fiberglass cloth (white and black), including reinforced.



TIZOL-FLOT
TIZOL-FLOT Fire
without covering



TIZOL-FLOT/AI1
TIZOL-FLOT Fire/AI1
TIZOL-FLOT/AIS1
TIZOL-FLOT Fire/AIS1
covering: aluminum foil/ foil,
reinforced with fiberglass fabric
(folma-fabric)



TIZOL-FLOT/TG1
TIZOL-FLOT Fire/TG1
TIZOL-FLOT/CGS1
TIZOL-FLOT Fire/CGS1
covering: fiberglass fabric/
reinforced fiberglass cloth



TIZOL-FLOT
Lamella

Designated purpose:

TIZOL-FLOT - plates with a low coefficient of thermal conductivity, with a density from 30 to 200 kg/m³ are used for thermal and sound insulation of hull structures, deckhead, ship premises of all types of sea and river crafts; they are available 1000 mm long, 500-600 mm wide, from 20 to 100 mm thick. Application temperature is from minus 180° to 700°C.

TIZOL-FLOT Fire with density of 50 and 100 kg/m³ are used as insulation in fire protection structures (decks, 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 density of 150 kg/m³ is used as insulation in fire-fighting structures of a floating floor of class A-60.

TIZOL-FLOT Lamella are cut into specified sizes from TIZOL-FLOT, TIZOL-FLOT Fire plates of appropriate density (from 80 to 200 kg/m³) with a certain direction of fibers to increase the rigidity of 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 brand products	
	TIZOL-FLOT	TIZOL-FLOT Fire
Density, kg/m ³	30 ÷ 200	50 ÷ 200
Coefficient of heat conductivity, W / (mK), no more, at a 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, % on weight, no more	0,5	0,5
Content of organic matter, % on weight, no more	3,0+4,0	3,0
Fire classification	non-combustible NC	

TIZOL-FLOT Pipe

TU 5762-015-08621635-2011

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

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



TIZOL-FLOT Pipe
without covering



TIZOL-FLOT Pipe AI
cylinders matted with aluminium foil

Designated purpose:

For thermal and sound insulation of steam pipelines, technical pipelines and air ducts with diameters from 12 mm to 1028 mm at application temperatures from minus 180°C to 700°C, on the surface of foil cylinders no more than 950°C.

PHYSICAL AND MECHANICAL PARAMETERS

Parameter name	Values for brand products	
	TIZOL-FLOT Pipe 80	TIZOL-FLOT Pipe 100
Density, kg/m ³	80±8	100±10
Coefficient of heat conductivity, W / (mK), no more, at a 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, % on weight, no more	0,5	0,5
Content of organic matter, % on weight, no more	4,0	4,0
Compressive strength at 10% deformation, kPa, not less	18,0	20,0
Fire classification	non-combustible NC	

МБОР

TY 5769-018-08621635-2013

МБОР - a basalt fireproof rolled material - is a layer of cloth made of basalt superfine fibers without a binder, stitched by knitting and stitching method with a thickness of 5, 8, 10, 13, 16 mm. It is available with or without a covering material.



МБОР
without a covering material



МБОР-С1, МБОР-С2
stitched with glass or basalt fabric on one or two sides



МБОР-В
matted with aluminium foil on one side

Designated purpose:

Thermal and sound insulation of ship structures of pipelines, air ducts, ventilation, smoke removal and air conditioning systems (including to avoid condensation), as well as high-temperature equipment and structures of all types of river and sea crafts.

It is used as a filter element in dry cleaning systems.

Application temperatures are from minus 180°C to 700°C, on the surface of foil cylinders no more than 1000°C.

PHYSICAL AND MECHANICAL PARAMETERS

Parameter name	Values for brand products				
	МБОР-5	МБОР-8	МБОР-10	МБОР-13	МБОР-16
Density not more, kg/m ³	100	100	100	120	120
Coefficient of heat conductivity, W / (mK), no more, at a temperature: (298±5)K (25±5)°C (398±5)K (125±5)°C (573±5)K (300±5)°C	0,035 0,052 0,090				
Humidity, % on weight, no more	2				
Surface density, g/m ² , not more than *	500	800	1000	1600	1900
Fire classification	non-combustible NC				

* The surface density on MBOR with covering material increases by 100-250 g/m².

MPB

TU 5769-002-08621635-98

MPB - mats stitched from basalt superfine fiber with density of 30-50 kg/m³. They are available with or without covering material, with thickness from 30 to 120 mm.



MPB-30
without covering material



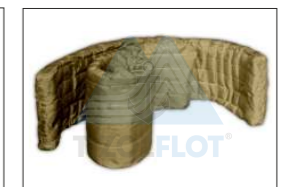
MPB-30/KF1, MPB-30/ST1
covered with foil or folma-fabric or fiberglass fabric on one side



MPB-30/CC1
covered with fiberglass mesh on one side



MPB-50/ST2
covered with silica or fiberglass fabric on both sides



MPB-50/BT2
covered with basalt fabric on both sides

Application temperature is from minus 180°C to plus 700°C.

By request of consumers it is possible to produce mats MPB-50 without covering and covered on one side with density of up to 50 kg/m³.

Designated purpose:

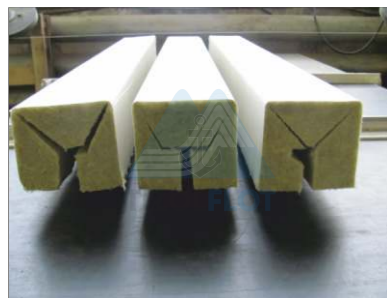
Thermal and sound insulation of ship structures, equipment, air ducts and pipelines.

PHYSICAL AND MECHANICAL PARAMETERS

Parameter name	The values for the mats, stamps	
	MPB-30, MPB-30/KF1, MPB-30/F1, MPB-30/ST1/EZ-200, MPB-30/ST1/T-13, MPB-30/ST1/T-23, MPB-30/KT1/KT-11, MPB-30/BT1/TBK-100, MPB-30/SS1	MPB-50/ST2/EZ-200, MPB-50/ST2/T-13, MPB-50/ST2/T-23, MPB-50/KT2/KT-11, MPB-50/BT2/TBK-100
Density, kg/m ³	25 - 40	41 - 60
Coefficient of heat conductivity, W / (mK), no more, at a temperature: (298±5)K (25±5)°C (398±5)K (125±5)°C (573±5)K (300±5)°C	0,038 0,060 0,110	0,038 0,060 0,095
Humidity, % on weight, no more	2	
Mass fraction of chlorine ions, %, not more than	0,03	
Compressibility, % by weight, not more	25	
Fire classification	non-combustible NC	

SETS OF DIFFERENT PROFILE

TU 5762-015-08621635-2011



They are available in the form of reamers for insulating stiffening ribs of various profiles (bulb flat, T-bar, angle bar) of given sizes from plates of required density with various covering materials: fiberglass fabric, fiberglass cloth, aluminum foil and glass fiber reinforced foil (folma-fabric).

Designated purpose:

Sets from **TIZOL-FLOT** with density from 50 to 150 kg/m³ are intended for heat and sound insulation of stiffening ribs of various profiles (bulb flat, T-bar, angle bar) of ship structures - decks, bulkheads, partitions.

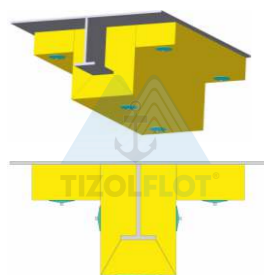
Application temperature is from minus 180°C to plus 700°C.

Sets from **TIZOL-FLOT Fire** with density from 50 to 150 kg/m³ are intended for insulation of stiffening ribs of various profiles (bulb flat, T-bar, angle bar) of ship are used in fire-fighting structures of class A (decks, bulkheads). structures - decks, bulkheads, partitions.

A set of symmetric, matted with folma-fabric T-shaped profile with a wall thickness of 5 mm, a wall size of 100 mm, a shelf thickness of 8 mm, a shelf size of 80 mm.

Thermal insulation thickness 50 mm.

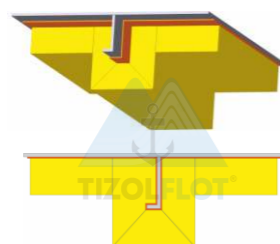
TIZOL-FLOT Fire 100/AIS NUPTS 5x100/8x80-T50



Set of angle section unit matted with folma-fabric with a shelf thickness of 3 mm, a shelf size of 100 mm and the second shelf thickness of 3 mm, the second shelf size 40 mm.

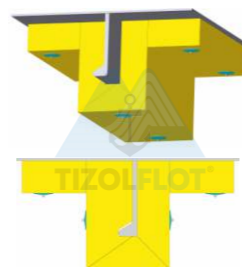
Thermal insulation thickness 30 mm.

TIZOL-FLOT 100/AIS NUPU 3x100/3x40-T30



Set of half bulb plate №8 matted with foil. Thermal insulation thickness 30 mm.

TIZOL-FLOT 100 AL NUPN8-T30



TECHNICAL PARAMETERS

Parameter name	TIZOL-FLOT	TIZOL-FLOT Fire
Density, kg/m ³	50-150	50-150
Coefficient of heat conductivity, W / (mK), no more, at a 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
Thickness, mm	20-100	25-100
Length, mm	1000±3	
Fire classification	non-combustible NC	
Type of coating	TG - fiberglass fabric CG - fiberglass cloth (black and white) AL - aluminum foil ALS - aluminum foil reinforced with fiberglass fabric (folma-fabric)	

INSULATION FOR COMFORT

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

The comfort indoors is determined by:

- stable internal air temperature;
- optimum relative humidity of air;
- the most favorable acoustic mode.

Decrease in heat losses

The cost of heating and air conditioning can be reduced to 70%, thanks to the use of high-quality insulation.

Thermal insulation products **TIZOL-FLOT** have a low coefficient of thermal conductivity and perfectly protect the structure from heat loss.

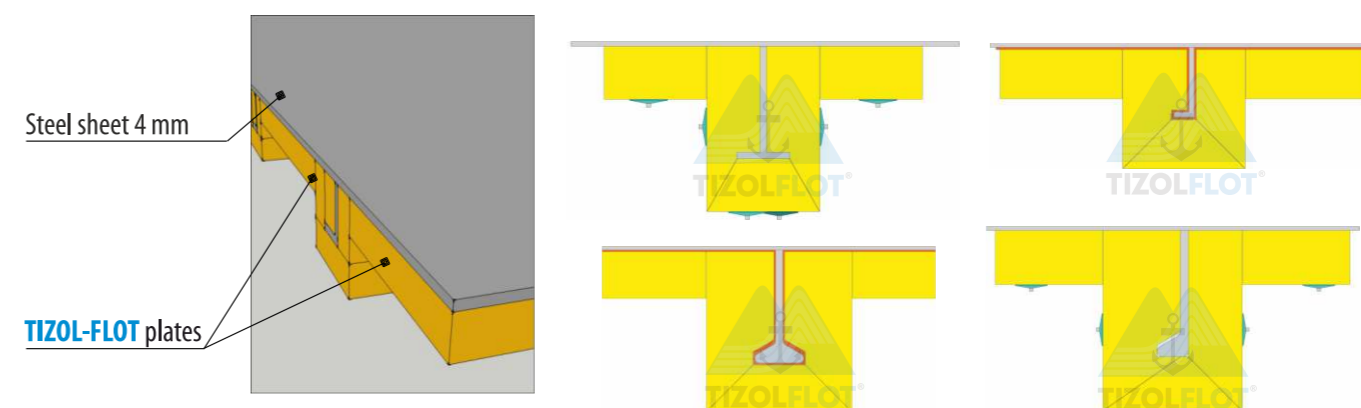
Sound absorption

The advantage of **TIZOL-FLOT** products is that along with excellent thermal insulation properties, they have high moisture resistance and excellent ability to noise absorption, reduce the level of impact and structural noise in the structures of "floating" floors, decks and bulkheads.

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

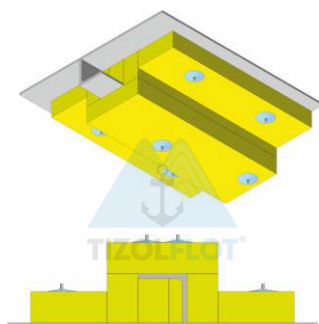
Sound insulation

Due to the light fibrous structure and sufficient density, **TIZOL-FLOT** materials have enhanced sound insulation properties: they not only protect the structure, but also do not collapse from sound vibrations. Application of **TIZOL-FLOT** allows providing sound insulation between adjacent cabins, public spaces (salons, restaurants, etc.) and living cabins.



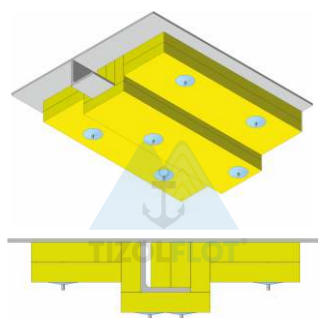
FIRE-PREVENTION STRUCTURES

Steel deck class A-30



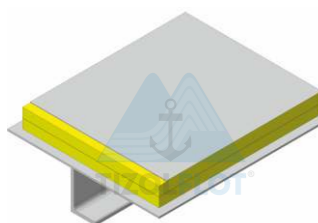
It consists of steel flooring 4.5 mm thick and stiffeners in the form of an angular profile 100x70x8 mm, installed at a distance of 600 mm from each other. Insulation of the main surface and stiffeners with a thickness of 25 mm. Insulation material is non-combustible plates "TIZOL FLOT fire 100" with a density of 100 kg/m³, thickness 25 mm. The plates are fixed with steel studs installed in 400 +/- 50mm pitch on the deck flooring and 150 +/- 50 mm on the stiffeners.

Steel deck class A-60



It is made of steel sheet with a thickness of 4.5 mm. Stiffeners in the form of the angular profile 100x70x8 mm at the distance of 600 mm. The insulation of the main surface is installed on the side of the stiffeners in two layers (with overlapping of joints, total thickness is 50 mm), on the stiffeners it is 25 mm thick. Insulation material is non-combustible plates "TIZOL FLOT fire 100" with a density of 100 kg/m³, thickness 25 mm. The plates are fixed with steel pins with an interval of 400 +/- 50mm on a steel base and 300 +/- 50 mm on the ribs.

Steel floating floor class A-60

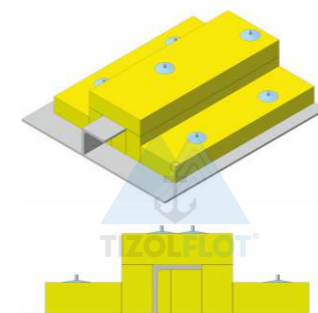


Steel deck with thickness of 4.5 mm insulated from the side opposite to the ribs with non-combustible plates "TIZOL FLOT fire 150" with density of 150 kg/m³, thickness of 25 mm. Insulation is installed in two layers with overlapping of joints, total thickness of 50 mm. The top layer of insulation is covered with a steel sheet with a thickness of 2 mm.

Fire resistance tests of structures were carried out in accordance with P10 2010, IMO resolution MSC.307(88) for compliance with the requirements of the "Rules of classification of construction of ships", "Rules of the Russian River Register" and Technical Regulations on the safety of Maritime and inland water transport.

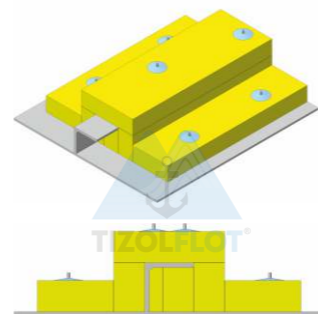
FIRE-PREVENTION STRUCTURES

General purpose steel bulkhead class A-30



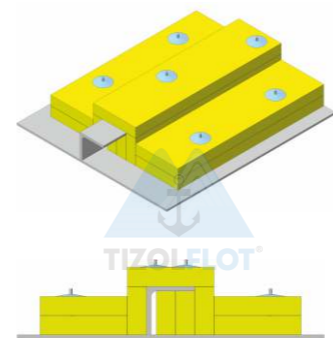
The impact of the flame is possible both from the insulation side and from the metal side. It consists of a steel shell with thickness of 4.5 mm and angle stiffening ribs 65x65x6mm, installed at a distance of 600 mm from each other. The 30 mm thick bulkhead insulation is installed on the side of the stiffeners. Insulation material is non-combustible plates "TIZOL FLOT fire 100" with density of 100 kg/m³, thickness of 30 mm. The plates are fastened with steel studs installed in 400 +/- 50 mm pitch on the stiffeners or on the "PLAZAS" adhesive composition.

Limited purpose steel bulkhead class A-60



Flame exposure is possible only from the side of insulation. It is made of steel sheet 4 mm thick. Vertical angle stiffening ribs 60x60x6 mm /bulb height of 60 mm. The distance between the ribs is 600 mm. Insulation is from stiffening ribs. Insulation material is non-combustible plates "TIZOL FLOT fire 100" with density of 100 kg/m³, thickness of 40 mm. Fastening of plates is both with steel pins with a pitch of 300 ... 400 mm, and the adhesive composition "PLAZAS".

General purpose steel bulkhead class A-60

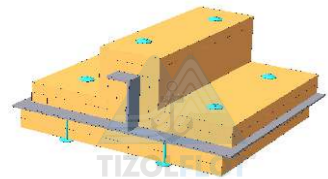


The impact of the flame is possible both from the insulation side and from the metal side. It is made of 4.5 mm thick steel sheet. Vertical angle stiffening ribs 65x65x6 mm at a distance of 600 mm. The insulation of the main surface is installed on the side of the stiffeners in two layers (with overlapping of joints, total thickness 50 mm), on the stiffeners - 25 mm thick. Insulation material is non-combustible plates "TIZOL FLOT fire 100" with density of 100 kg/m³, thickness 25 mm. The plates are fastened with steel studs, with an interval of 400 +/- 50 mm on a steel base and 300 +/- 50 mm on the stiffening ribs.

Fire resistance tests of structures were carried out in accordance with P10 2010, IMO resolution MSC.307(88) for compliance with the requirements of the "Rules of classification of construction of ships", "Rules of the Russian River Register" and Technical Regulations on the safety of Maritime and inland water transport.

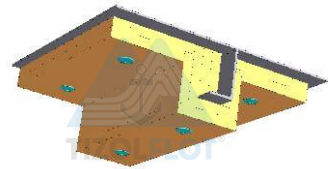
FIRE-PREVENTION STRUCTURES

Aluminum bulkhead class A-60



It consists of an aluminum shell with thickness of 6 mm and angle stiffening ribs 100x75x9 mm, installed at a distance of 600 mm from each other. Insulation of the bulkhead is installed on both sides in two layers with overlapping of joints; the total thickness is 50 mm on each side. Insulation material is non-combustible plates "TIZOL FLOT fire 100" with density of 100 kg/m³, thickness 25 mm. The plates are fastened with aluminum I studs, with an interval of 400 +/- 50 mm on the bulkhead shell and 300 +/- 50 mm on the stiffening ribs.

Aluminum deck class A-60



It consists of aluminum flooring with a thickness of 6 mm and angle stiffening ribs 150x100x9 mm, installed at a distance of 600 mm from each other. Deck insulation is installed on the side of the stiffening ribs in two layers (with overlapping of joints, the total thickness of 50 mm), on the ribs - 50 mm thick. Insulation material is non-combustible plates "TIZOL FLOT fire 100" with density of 100 kg/m³, thickness 25 mm. The plates are fastened with I studs, with an interval of 400 +/- 50 mm on the deck flooring and 150 +/- 50 mm on the stiffening ribs.

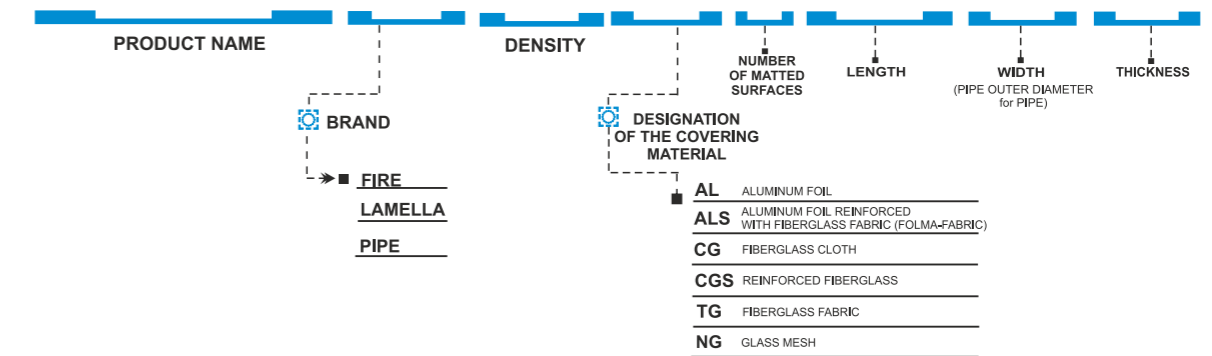


Fire resistance tests of structures were carried out in accordance with PIO 2010, IMO resolution MSC.307(88) for compliance with the requirements of the "Rules of classification of construction of ships", "Rules of the Russian River Register" and Technical Regulations on the safety of Maritime and inland water transport.

DESIGNATION AND APPLICATION OF PRODUCTS

«TIZOL-FLOT», «TIZOL-FLOT Fire», «TIZOL-FLOT Lamella», «TIZOL-FLOT Pipe»

TIZOL-FLOT Fire 100/ AL 1 1000x600x50



Ship structures	Designation	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-structures	fire proof insulation												•	•	•	•	•						
Hull structures	heat and sound insulation	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•				•	•	•
Floating floors	fire proof insulation															•	•						
Sandwich panels	heat and sound insulation					•	•	•	•	•	•	•									•	•	•
Pipes	heat and sound insulation								•	•								•	•				
Reservoirs	fire proof insulation												•	•	•	•	•						
	heat and sound insulation	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•			•	•		
Air ducts	heat and sound insulation					•	•	•					•	•	•					•	•		
Chimneys	fire proof insulation												•	•	•								
	heat 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" TU 5772-014-08621635-2012

Adhesive composition "PLAZAS", made on the basis of silicate binders, mineral fillers and modifying additives, has excellent adhesion to metal, concrete, wooden surfaces and insulating materials from basalt, belongs to the group of non-combustible materials, has certificates and certificates of approval of Sea and River registers. The coating on the basis of adhesive composition is designed for operation at temperatures from minus 70°C to 800°C and humidity up to 98% both indoors and outdoors, when providing conditions that exclude the impact of precipitation directly on the adhesive composition.

MATERIAL SPECIFICATION

Thermal insulation of hull structures with TIZOL-FLOT plates

Brand of insulation material	Coefficient of thermal conductivity $\lambda_{10^\circ\text{C}/\lambda_{25^\circ\text{C}} \text{ W / mk}$	Density kg/m^3	Length, mm	Plate width, mm	Plate thickness, mm	Plate area, m^2	Plate volume, m^3	Airborne sound insulation index (single-wall construction with 4 mm sheet thickness) $R_w \text{ dB}$	Airborne sound insulation index (double-wall construction with 2 mm sheet thickness) $R_w \text{ dB}$	Sound Absorption Index α_w
TIZOL-FLOT 30	0,037 / 0,04	30	1000	500 / 600	50	0,50 / 0,60	0,025 / 0,030	-	-	-
					60	0,50 / 0,60	0,030 / 0,036			
					70	0,50 / 0,60	0,035 / 0,042			
					80	0,50 / 0,60	0,040 / 0,048			
					90	0,50 / 0,60	0,045 / 0,054			
					100	0,50 / 0,60	0,050 / 0,060			
TIZOL-FLOT 40	0,036 / 0,038	40	1000	500 / 600	30	0,50 / 0,60	0,015 / 0,018	-	-	-
					40	0,50 / 0,60	0,020 / 0,024			
					50	0,50 / 0,60	0,025 / 0,030			
					60	0,50 / 0,60	0,030 / 0,036			
					70	0,50 / 0,60	0,035 / 0,042			
					80	0,50 / 0,60	0,040 / 0,048			
TIZOL-FLOT 50	0,035 / 0,038	50	1000	500 / 600	30	0,50 / 0,60	0,015 / 0,018	-	-	-
					40	0,50 / 0,60	0,020 / 0,024			
					50	0,50 / 0,60	0,025 / 0,030			
					60	0,50 / 0,60	0,030 / 0,036			
					70	0,50 / 0,60	0,035 / 0,042			
					80	0,50 / 0,60	0,040 / 0,048			
TIZOL-FLOT 60	0,035 / 0,038	60	1000	500 / 600	30	0,50 / 0,60	0,015 / 0,018	-	-	-
					40	0,50 / 0,60	0,020 / 0,024			
					50	0,50 / 0,60	0,025 / 0,030			
					60	0,50 / 0,60	0,030 / 0,036			
					70	0,50 / 0,60	0,035 / 0,042			
					80	0,50 / 0,60	0,040 / 0,048			
TIZOL-FLOT 80	0,034 / 0,036	80	1000	500 / 600	30	0,50 / 0,60	0,015 / 0,018	-	-	-
					40	0,50 / 0,60	0,020 / 0,024			
					50	0,50 / 0,60	0,025 / 0,030			
					60	0,50 / 0,60	0,030 / 0,036			
					70	0,50 / 0,60	0,035 / 0,042			
					80	0,50 / 0,60	0,040 / 0,048			
TIZOL-FLOT 100	0,034 / 0,037	100	1000	500 / 600	30	0,50 / 0,60	0,015 / 0,018	-	-	-
					40	0,50 / 0,60	0,020 / 0,024			
					50	0,50 / 0,60	0,025 / 0,030			
					60	0,50 / 0,60	0,030 / 0,036			
					70	0,50 / 0,60	0,035 / 0,042			
					80	0,50 / 0,60	0,040 / 0,048			

Fire insulation of ship structures with TIZOL-FLOT Fire plates

Brand of insulation material	Density, kg/m^3	Length, mm	Plate width, mm	Plate thickness, mm	Plate area, m^2	Plate volume, m^3	Insulation weight per 1 m^2	Number of fasteners PCs per 1 m^2	Weight of fastener per 1 m^2	Coefficient of thermal conductivity $\lambda_{10^\circ\text{C}/\lambda_{25^\circ\text{C}} \text{ W / mk}$	Sound Absorption Index α_w	Airborne sound insulation index (single-wall construction with 4 mm sheet thickness) $R_w \text{ dB}$
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 80	80	1000	500 / 600	25x2	0,50 / 0,60	0,025 / 0,030	4,00	9	0,070	0,034 / 0,037	0,80	-
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 SPECIFICATION

Thermal insulation of panels with TIZOL-FLOT Lamella

Brand of insulation material	Density, kg/m^3	Length, mm	Width, mm	Thickness, mm	Coefficient of thermal conductivity $\lambda_{10^\circ\text{C}/\lambda_{25^\circ\text{C}} \text{ W / mk}$	Plate, m^2	Volume, m^3	Insulation weight per 1 m^2 , 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

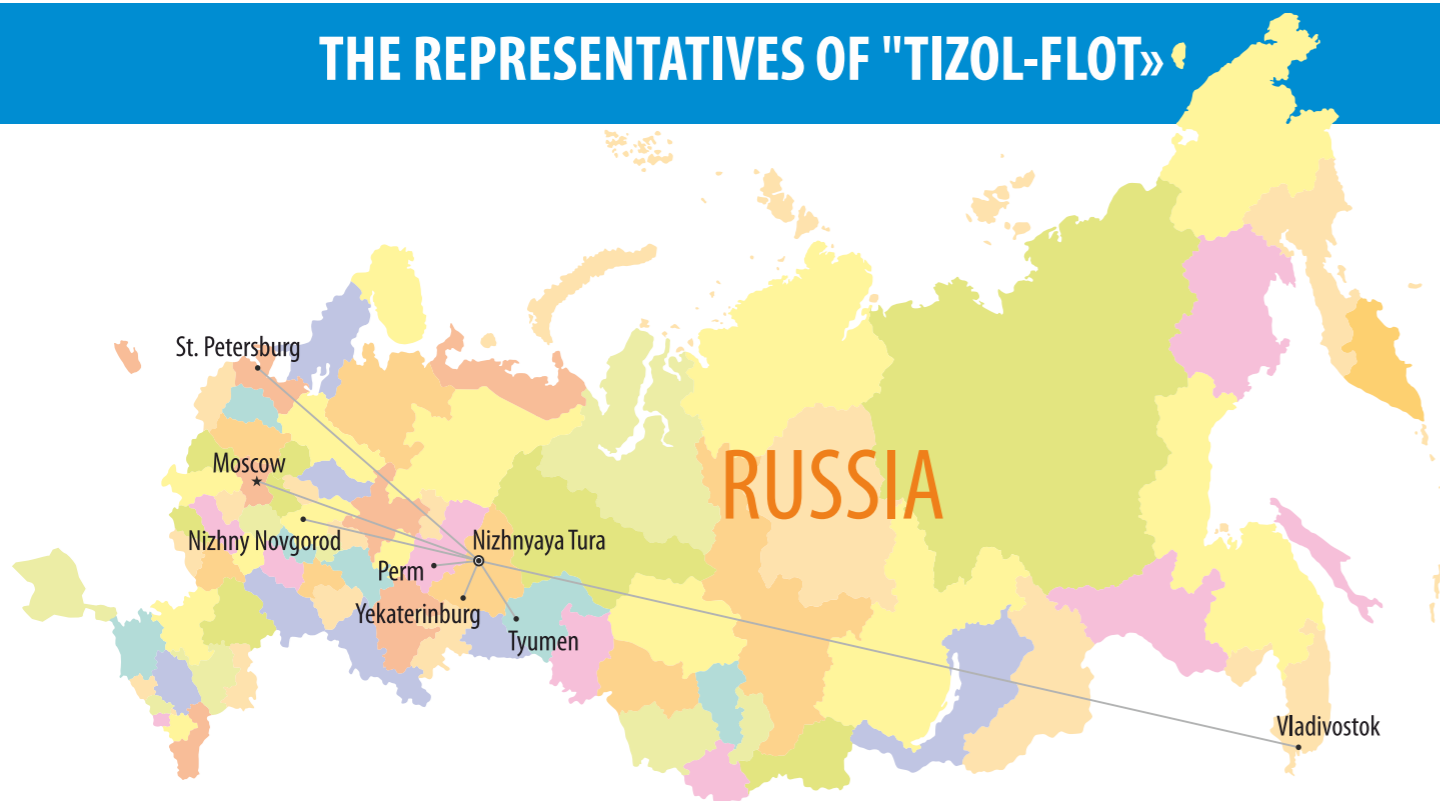
Thermal insulation of ship equipment with rolled material MBOR

Brand of insulation material	Length, mm	Width, mm	Thickness, mm	Insulation weight per 1 m^2 , kg	Number of fasteners PCs per 1 m^2	Weight of fastener per 1 m^2	Coefficient of thermal conductivity $\lambda_{10^\circ\text{C}/\lambda_{25^\circ\text{C}} \text{ W / mk}$	Sound Absorption Index α_w	Airborne sound insulation index (single-wall construction with 0.8 mm sheet thickness) $R_w \text{ dB}$
MBOR-5	30000	1500	5	0,50	9	0,70	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			0,15	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 mats MPB

Brand of insulation material	Density, kg/m^3	Length, mm	Width, mm	Thickness, mm	Coefficient of thermal conductivity $\lambda_{10^\circ\text{C}/\lambda_{25^\circ\text{C}} \text{ W / mk}$	Plate, m^2	Volume, m^3	Sheathing insulation			Sound Absorption Index α_w		
								Insulation weight per 1 m^2 depending on the type of coating					
								without coating	fiberglass	foil			
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-50	50	1500	500	30	0,030 / 0,032	0,75	0,023	1,50	2,18	—	0,95		
				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	—	—

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"TIZOL-FLOT" ON SEA AND RIVER CRAFTS

- Tanker "Yuli Makarenkov" (Nobel Brothers Shipyard, project RST25, 2012)
- Tanker VF 1-10 (Krasnoe Sormovo, project RST27, 2011-2014)
- Tanker VF 11-22 (Red Sormovo, project RST27, 2012-2013)
- The ship platform/tanker "Baltic fleet 1-5" (Oka shipyard, project RST54, 2014-2017)
- Rescue ship "Igor Belousov" (Admiralty Shipyards, Project 21300, 2012)
- Patrol icebreaker "Ivan Papanin" (Admiralty shipyards, project 23550)
- Researcher "Seliger" (PSZ "Yantar", project 11982, 2012)
- Researcher "Yantar" (PSZ "Yantar", project 22010, 2011)
- Supply vessel "Ivan Sidorenko" (Amursky SZ, project 22420, 2014)
- Supply vessel "Ostap Sheremet" (Amursky SZ, project 22420, 2014)
- Corvettes (Amursky SZ, project 20380, 2011-2018):
 - "Sovershennyi" "Gromky"
 - "Geroy RF Aladar C" "Rezky"
- Corvettes (Northern shipyard, project 20 380, 2008-2017):
 - "Steregushchy" "Soobrazitelnyi"
 - "Boyky" "Stoyky"
 - "Retiviyi" "Strigy"
 - "Gremyashchy" "Provorniy"
- Patrol ship "Polyarnaya Zvezda" (Zelenodolsk, Gorky Plant, Project 11611E, 2013)
- Transport dock "Sviyaga" (Zelenodolsk, Gorky Plant, project 22570, 2014)
- Emergency and rescue craft "Beringov proliv" (Nordic Yards, project MPSV 06, 2014)
- Emergency vessel "Murman" (Nordic Yards, project MPSV 06, 2014)
- Patrol boat "Mangust" (Vympel, project 12150, 2012)
- Maritime transport of weapons "Gennady Dmitriev" (Vympel, project 20360M, 2018)
- Maritime transport of weapons "Vladimir Pyalov" (Vympel, project 20360M)
- The buoy tender "Ladozhsky" (ZNT, project BLV02, 2012-2013)
- The buoy tender "Buran" (ZNT, project BLV02, 2012-2013)
- Tankers (Yaroslavsky SZ, project RT18, 2013): "Tanker-3", "Rassvet", "Pyatimorsk"
- The guard ship "Balaklava" (Yaroslavsky SZ, project 10410 2018)
- The guard ship "Kerch" (Almaz SZ, project 10410, 2018)
- Fishing vessel "Konstantin Konstantinov" (Pella, project PL475, 2013-2015)
- Service ship "Akademik Kovalev" (CA "Zvezdochka", project 20180TV, 2014)
- Service ship "Akademik Aleksandrov" (CA "Zvezdochka", project 20183)
- Dry cargo ship "Ediny" (Balakovskiy GCC, project RSD60, 2017)
- Dredger "Kadosh" (Red Sormovo, project THSD1000, 2016)