Properties of Fibreglass Reinforced Plastic Bars

Fibreglass Reinforced Plastic Bars being a typical material used for reinforcing concrete structures are definitely the newest and most relevant composites having special physical and technical characteristics ahead of their traditional metal analogues. Demonstration of the positive or negative properties of the fibreglass frame directly depends on the conditions of its use.

Prospects for using multicomponent reinforcing bars are attributable to a number of their positive qualities:

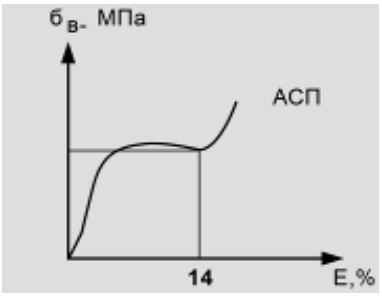
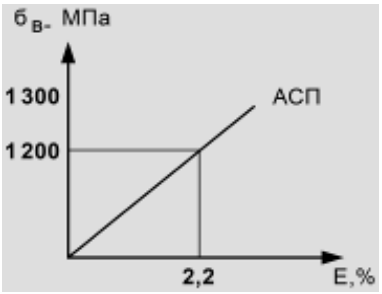
1. Corrosion Resistance. Fibreglass reinforced plastic frame for reinforcing concrete structures is highly resistant to corrosion processes. They may not be affected by the negative factors of alkaline and aggressive environments, salt, chemical additives and substances, as well as other products of various processes. These qualities increase the popularity and priority need for fibreglass reinforced plastic bars for reinforcing structures of coastal and waterside facilities, pavements, coatings in livestock breeding complexes, food and processing industries, treatment plants and settling tanks.

2. Dielectric Properties. Fibreglass reinforced plastic bars do not allow passing electric current thus creating their special value in reinforcing walls and entablements in certain research facilities. These are construction complexes where the use of steel frames is not allowed, since it affects the operation results of the instruments used for measuring electromagnetic waves. This is especially critical in medical institutions where magnetic resonance imaging complexes are installed. As for the civil buildings, the absence of a screen in the premises eliminates the problem of the radio wave passage and makes them as accessible as possible for mobile communications (telephony, Internet). Also, when replacing steel reinforcing bars with fibreglass reinforced plastic bars the negative impact of the screen on the human biofield disappears, which makes his life environmentally friendly and safe.

3. Light Weight. Fibreglass Reinforced Plastic Bars are much lighter than a steel frame. And the high strength of the structures, where the reinforcing bars are designed for stretching, allows the weight difference to be increased up to 2 times. The use of our reinforcing bars in concrete structures allows making them lighter thus reducing the load on the foundation. Here, it is also very important to note that there is no risk of corrosion, which reduces concrete by one more, additional, protective layer against external factors. The lightness of the reinforcing bars makes it possible to simplify the process of its transportation and installation, reduce financial and time costs being very important for any project.

4. Temperature Resistance. A positive property of the fibreglass reinforced plastic bars is a complete lack of sensitivity to seasonal phenomena and temperature differences. The operation temperature range of the main reinforcing bar components varies from -70 to +100 C. Various temperature conditions and a high humidity coefficient do not affect the construction and operation of concrete blocks with a fibreglass reinforced plastic frame. When concreting some structures, steaming is used to reduce the hardening time of concrete. During this process, the reinforcing bars within the structure will be exposed to high temperature and moisture. Afterwards, the facilities will be used at high positive and low sub-zero temperatures. Such serious test for steel reinforcing bars entails the risk of accelerated corrosion. The influence of these conditions on fibreglass will be minimized.

Physical and Mechanical Characteristics of steel and fibreglass reinforced plastic bars

Characteristics	Metal reinforcing bars of class A-III GOST 5781-82	Fibreglass Reinforced Plastic Bars
Material	Steel 35GS, 25G2S etc.	Fibreglass with a diameter of 13–16 microns bound by a polymer
Ultimate tensile strength, MPa	360 - 390	1 200 - 1 500
Modulus of elasticity, MPa	200 000	55 000
Elongation, %	25	8 - 10
Mode of behaviour under load (dependence "tension-deformation")	 Toughness under load	 Linear elastic dependence up to destruction
Linear expansion coefficient, αx10-5/ºC	13 - 15	9 - 12
Corrosion resistance to aggressive environments	Corrodes with emission of rust	Corrosion-proof material of the first group of chemical resistance including to the alkaline environment of concrete
Thermal conductivity	Thermally-conductive	Thermally non-conductive
Electrical conductivity	Electrically-conductive	Dielectric
Available Profiles	6 - 80	20-bal
Length	Rods 6 - 12 m long	Any length on the customer's request
Environmental friendliness	Environmental friendly	Does not emit harmful and toxic substances
Durability	According to building codes	Projected durability of at least 100 years
Parameters of equal-strength reinforcing frame at a load of 25 t/m²	When using the reinforcing bars 8AIII, the cell size is 14×14 cm. Weight 5.5 kg/m²	When using reinforcing bars 8AKS, the cell size is 23×23 cm. Weight 0.61 kg/m². Lighting by 9 times
Scope of Application	According to the Construction Rules	Application according to recommendations of Concrete and Reinforced Concrete Research Institute It is especially effective in the construction of foundations and monolithic works, as well as in road construction for products working on an elastic foundation (foundations and slopes of roads, asphalt concrete pavement, retaining walls, slabs, etc.). It is promising for creating earthquake-resistant zones of buildings and structures both existing and newly erected.

	Metal reinforcing bars A-III (A400C) GOST 5781-82	Fibreglass Reinforced Plastic Bars TU 2292-001-11733958-2013
Material	Steel 35GS, 25G2S etc.	Fibreglass with a diameter of 13–16 microns bound by a polymer
D, mm	6	4
Breaking force (rated), N	10 188	10 800
Cross-section area, sq. mm	28,3	13,5
Weight per 1 lineal meter, kg	0,22	0,02
Quantity of lineal meters in 1 t	4 545	50 000
Tensile strength, MPa	390	860
Modulus of elasticity, MPa	200 000	55 000
Elongation, %	25	2,2
Thermal conductivity coefficient, W/(mºC)	46	0,35
Mode of behaviour under load (dependence "tension-deformation")	Curved line with yield strength under load	Straight line with elastic-linear dependence under load up to destruction
Linear expansion coefficient, αx10-5/ºC	13 - 15	9 - 12
Density, t/m³	7	1,9
Thermal conductivity	Thermally-conductive (56 W/m2)	Thermally non-conductive (0.48 W/m2)
Electrical conductivity	Electrically-conductive	Dielectric

	Metal reinforcing bars A-III (A400C) GOST 5781-82	Fibreglass Reinforced Plastic Bars TU 2292-001-11733958-2013
Material	Steel 35GS, 25G2S etc.	Fibreglass with a diameter of 13–16 microns bound by a polymer
D, mm	8	6
Breaking force (rated), N	18 108	23 360
Cross-section area, sq. mm	50,3	29,2
Weight per 1 lineal meter, kg	0,4	0,04
Quantity of lineal meters in 1 t	2 530	25 000
Tensile strength, MPa	390	860
Modulus of elasticity, MPa	200 000	55 000
Elongation, %	25	2,2
Thermal conductivity coefficient, W/(mºC)	46	0,35
Mode of behaviour under load (dependence "tension-deformation")	Curved line with yield strength under load	Straight line with elastic-linear dependence under load up to destruction
Linear expansion coefficient, αx10-5/ºC	13 - 15	9 - 12
Density, t/m³	7	1,9
Thermal conductivity	Thermally-conductive (56 W/m2)	Thermally non-conductive (0.48 W/m2)
Electrical conductivity	Electrically-conductive	Dielectric

	Metal reinforcing bars A-III (A400C) GOST 5781-82	Fibreglass Reinforced Plastic Bars TU 2292-001-11733958-2013
Material	Steel 35GS, 25G2S etc.	Fibreglass with a diameter of 13–16 microns bound by a polymer
D, mm	12	8
Breaking force (rated), N	40 716	40 960
Cross-section area, sq. mm	113,1	51,2
Weight per 1 lineal meter, kg	0,89	0,08
Quantity of lineal meters in 1 t	1 126	12 500
Tensile strength, MPa	390	860
Modulus of elasticity, MPa	200 000	55 000
Elongation, %	25	2,2
Thermal conductivity coefficient, W/(mºC)	46	0,35
Mode of behaviour under load (dependence "tension-deformation")	Curved line with yield strength under load	Straight line with elastic-linear dependence under load up to destruction
Linear expansion coefficient, αx10-5/ºC	13 - 15	9 - 12
Density, t/m³	7	1,9
Thermal conductivity	Thermally-conductive (56 W/m2)	Thermally non-conductive (0.48 W/m2)
Electrical conductivity	Electrically-conductive	Dielectric

	Metal reinforcing bars A-III (A400C) GOST 5781-82	Fibreglass Reinforced Plastic Bars TU 2292-001-11733958-2013
Material	Steel 35GS, 25G2S etc.	Fibreglass with a diameter of 13–16 microns bound by a polymer
D, mm	14	10
Breaking force (rated), N	55 440	63 600
Cross-section area, sq. mm	154	79,5
Weight per 1 lineal meter, kg	1,21	0,13
Quantity of lineal meters in 1 t	826	7 692
Tensile strength, MPa	390	860
Modulus of elasticity, MPa	200 000	55 000
Elongation, %	25	2,2
Thermal conductivity coefficient, W/(mºC)	46	0,35
Mode of behaviour under load (dependence "tension-deformation")	Curved line with yield strength under load	Straight line with elastic-linear dependence under load up to destruction
Linear expansion coefficient, αx10-5/ºC	13 - 15	9 - 12
Density, t/m³	7	1,9
Thermal conductivity	Thermally-conductive (56 W/m2)	Thermally non-conductive (0.48 W/m2)
Electrical conductivity	Electrically-conductive	Dielectric

	Metal reinforcing bars A-III (A400C) GOST 5781-82	Fibreglass Reinforced Plastic Bars TU 2292-001-11733958-2013
Material	Steel 35GS, 25G2S etc.	Fibreglass with a diameter of 13–16 microns bound by a polymer
D, mm	16	12
Breaking force (rated), N	72 360	91 200
Cross-section area, sq. mm	201	114
Weight per 1 lineal meter, kg	1,58	0,2
Quantity of lineal meters in 1 t	633	5 000
Tensile strength, MPa	390	860
Modulus of elasticity, MPa	200 000	55 000
Elongation, %	25	2,2
Thermal conductivity coefficient, W/(mºC)	46	0,35
Mode of behaviour under load (dependence "tension-deformation")	Curved line with yield strength under load	Straight line with elastic-linear dependence under load up to destruction
Linear expansion coefficient, αx10-5/ºC	13 - 15	9 - 12
Density, t/m³	7	1,9
Thermal conductivity	Thermally-conductive (56 W/m2)	Thermally non-conductive (0.48 W/m2)
Electrical conductivity	Electrically-conductive	Dielectric