



STRESS-STRAIN STATE OF HIGH-STRENGTH STEEL REINFORCEMENT

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Annotation.

The article discusses the possibility of evaluating and comparing the physical, mechanical and deformative properties of steel reinforcement for widespread use in construction.

Key words: Reinforcing steel, deformability, physical and mechanical properties.

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The relevance of the problem of evaluating the physical, mechanical and deformative properties of steel reinforcement for different classes of periodic profile. This is due to the need to derive the qualities of metallurgical industrial enterprises for the CIS countries [1,2,3,4].

The main purpose of this study is to test the stress-strain state of rod steel, fiberglass and various classes of reinforcement under short-term load action.

To achieve this goal, the following tasks were solved during the study:

-development of methodology and production of prototypes, steel fittings of classes A240, A500c, A600c, SPA

--conducting tests of samples with a short-term load before destruction.

-analysis of the experimental data obtained and comparison with standard calculation methods.

To assess the physical and mechanical properties of the reinforcement, prototypes were made and tensile tests were carried out.

Table 1 - General characteristics according to GOST[5,6,7]

№ п/п	Characteristicsofthereinforcement	Steel fittings GOST 5781-82 GOST 52544-2006 Fiberglass fittings TU 2296-001- 60722703-2010			Steel fittings GOST 5781-82 GOST 52544-2006 Fiberglass fittings TU 2296- 001-60722703-2010
		класс	σ_B	σ_T	
1	Mechanical characteristics under tension, $\sigma, N/ [mm]^2$	A240	373	235	1300
		A500	633,6	390	
		A600	883	390	
2	Elongation, $e_P, \%$	A240, A500 A600		6,7,6	2,2
3	Modulus of elasticity, $E_S,$ $N/ [mm]^2$ (Hpa)	200000 (200)			55000 (55)
4	Density, $g/ [cm]^3$	7,85			1,9
5	Corrosionresistance	Corrosion- resistantStainlessmaterial			Corrosion- resistantStainlessmaterial
6	Ratio	13-15			9-12



7	Coefficient of thermal conductivity, W/(m*K)	46	0,35
8	Electrical Properties	Electrically Conductive Non-Electrically Conductive Is a dielectric	Electrically Conductive Non-Electrically Conductive Is a dielectric
9	Magnetic properties	DiamagnetMagneticCore	DiamagnetMagneticCore
10	Durability	In accordance with building codes, the predicted durability is at least 80 years	In accordance with building codes, the predicted durability is at least 80 years

To assess the physical and mechanical properties of valves of different classes, they were carried out on an instron 1000HDX testing machine and simultaneously measured stresses and elongation by an extensometer sensor.

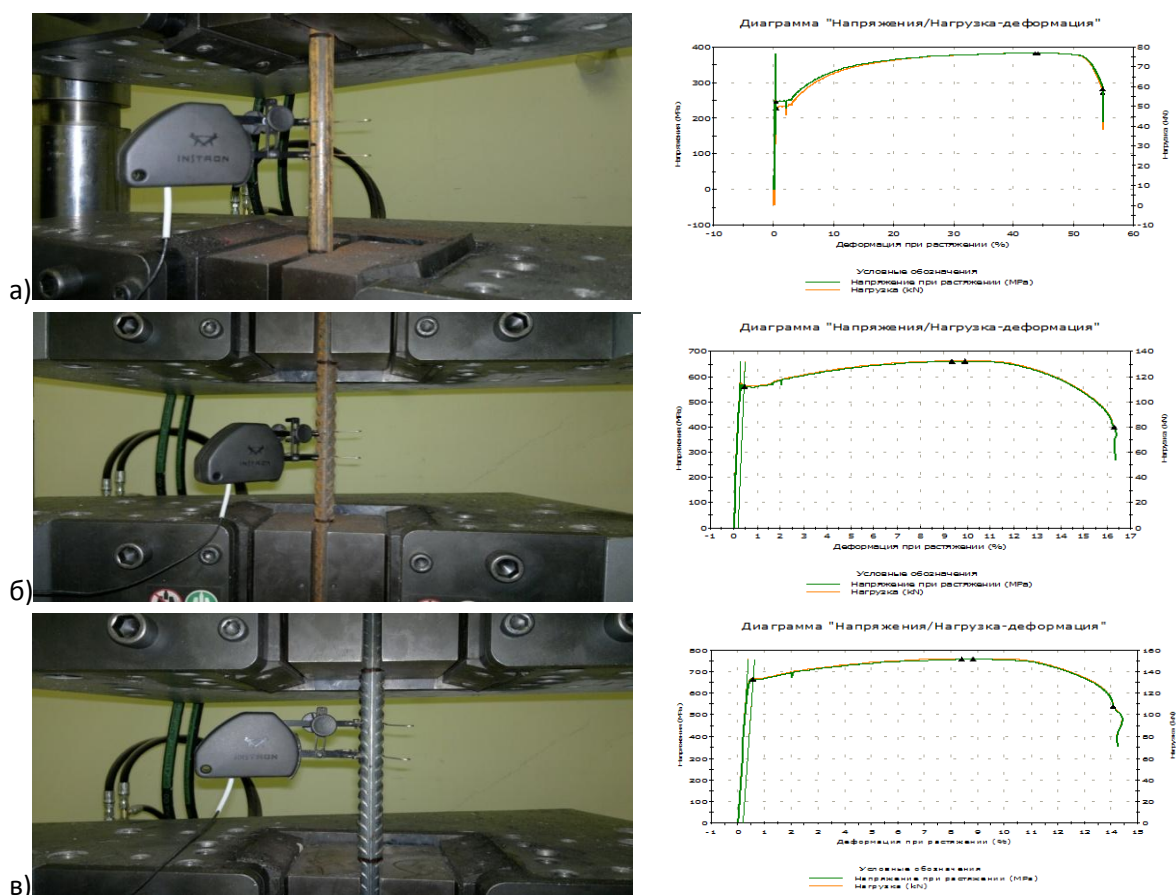


Figure 1 - (a.b.c). Reinforcement deformation diagram « $\sigma - \varepsilon$ »

- a) -a sample when testing steel reinforcement A240
- b) -a sample when testing steel reinforcement A500C
- c) -a sample when testing A600C steel reinforcement

Table 2 - characteristics of prototypes after testing



	Samplelabel	Diameter(mm)	Cross-sectional area, mm ² (mm ²)	Estimatedlength h, mm	Lengthafterrupture , mm
1	A600c	16,00	201,1	160,0	185,0
2	A600c	16,00	201,1	160,0	183,0
3	A500c	16,00	201,1	160,0	187,0
4	A500c	16,00	201,1	160,0	187,0
5	A240	16,00	201,1	160,0	221,3
6	A240	16,00	201,1	160,0	238,0

The combined diagram of deformation of samples Ø16 mm from reinforcing steels of classes A240; A500C and A600C used in the manufacture of prototypes is given.

Образцы с 1 по 6

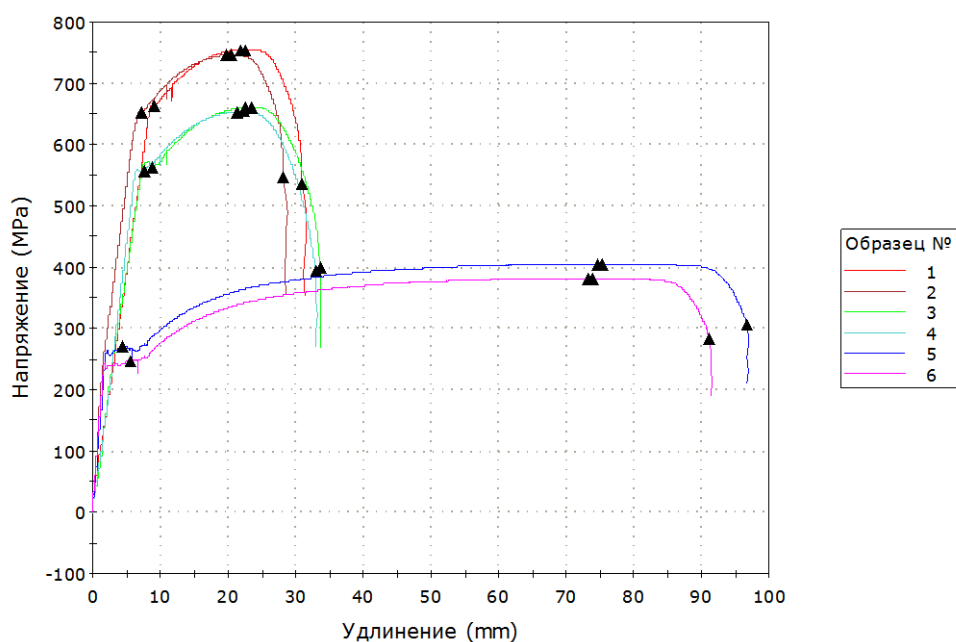


Figure 2 - Combined deformation diagram after testing for reinforcement classes A240, A500C and A600C

Table 3 - Results of tensile tests of prototypes

	Yield strength (MPa)	Yield stress (kN)	Maximum tensile stress (MPa)	Maximum load (kN)	Stress under destructive force (MPa)	Destructive force (kN)	Relative elongation, (%)	Module (MPa)
1	662,5	133,2	754,7	151,7	536,6	107,9	15,6	181595,82520
2	653,7	131,4	745,9	150,0	547,1	110,0	14,4	229177,09961
3	560,9	112,8	660,8	132,9	400,4	80,5	16,9	211272,90039
4	558,0	112,2	653,9	131,5	393,6	79,1	16,9	212089,50195
5	269,6	54,2	404,7	81,4	305,7	61,5	38,3	1937939,84375



	Yield strength (MPa)	Yield stress (kN)	Maximum tensile stress (MPa)	Maximum load (kN)	Stress under destructive force (MPa)	Destructive force (kN)	Relative elongation, (%)	Module (MPa)
6	245,9	49,4	381,9	76,8	282,3	56,8	48,8	211121,53320

Conclusions:

The magnitude of the ultimate deformations of the prototypes under the short - term action of the load was $(1,57-1,90) \cdot 10^{-3}$, which led to the achievement of the yield strength in valves of classes A240, A500C and A600C. The stresses in the fiberglass reinforcement (SPA) have not reached the elastic limit. Due to the low value of the elastic modulus of fiberglass (SPA) reinforcement, its effect on increasing the bearing capacity of compressed elements is insignificant. The experimental and calculated values of the destructive load of the prototypes showed good convergence of the results. The discrepancy between the experience of its calculation is 0.5 - 13%.

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