(Ural Scientific and Research Institute of Construction Materials established in 1957)

Testing Center
Ural Scientific and Research Institute of Construction Materials

Accreditation Certificate No. POCC RU.0001.517489 (valid until October 09,2017)

454247, Chelyabinsk
Stalevarov str., 5, bldg. 2, P.O. box 5177
Tel./fax (351) 735-98-08
217-08-12
nii@7359808.ru
www.uniis.ru

Registration No. 1515/16
Dated May 24, 2016

APPROVED BY
Director General
UralNIIStrom, LLC
Ph.D. in Technical Science
/Signature/ R.Ya. Akhtyamov
Seal: Limited Liability Company Ural Scientific and Research Institute of Construction Materials * city of Chelyabinsk *

REPORT

on Scientific and Research Activity

COMPOSITE GROUP CHELYABINSK

Testing of composite fiberglass reinforcement of AKC grade of Ø8 mm for compliance with GOST 31938 requirements

(Contract No. 100/2015 dated March 17, 2015)

Deputy Supervisor of Testing Center of UralNIIStrom, LLC, Ph.D. in Technical Science — */Signature/ 24.05.2016* A.A. Gabdrakhmanova (signature, date)

Deputy Director General on Scientific Activity UralNIIStrom, LLC, Ph.D. in Technical Science — */Signature/* R.M. Akhmedyanov (signature, date)

Chelyabinsk

2016

LIST OF EXECUTORS

Test Supervisor Head of Laboratory of Physical and Mathematical Research of Testing Center of UralNIIStrom, LLC	*/Signature/ 24.05.2015* signature, date	*A.A. Konoplyov*
Test Executors:		
Head of Laboratory of Physical and Mechanical Research of Testing Center of UralNIIStrom, LLC	*/Signature/ 24.05.2015* signature, date	*A.A. Konoplyov*
Research Engineer of Testing Center of UralNIIStrom, LLC	*/Signature/ 24.05.2015* signature, date	*A.V. Shchelkanova*
Research Engineer of Testing Center of UralNIIStrom, LLC	*/Signature/ 24.05.2015* signature, date	*R.A. Yanturina*
Research Engineer of Testing Center of UralNIIStrom, LLC	*/Signature/ 24.05.2015* signature, date	*D.V. Bogisevich*

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INTRODUCTION

The tests have been performed upon an order of Composite Group, LLC (Contract No.100/2015 dated 17.03.2015), scope of works defined by the technical assignment (Appendix No. to the Contract).

Tested object: Fiberglass reinforcement of AKC grade of 8 mm diameter.

Sample tagging – fiberglass reinforcement of AKC grade 08 mm.

Address of the manufacturer of the tested objects: Chelyabinsk, 2nd Paveletskaya str., 36.

Name of the manufacturer of the tested objects: Composite Group, LLC.

Sampling reports (number, date): No. dated October 28, 2015. No.2 dated November 05, 2015.

Test purpose: Determination of physical and mechanical characteristics of fiberglass reinforcement for compliance with the requirements of GOST 31938-2012 "Composite polymer reinforcement for armoring concrete structures. General specifications".

Test conditions – temperature of 23,2°C, humidity of 49,5%.

Physical and mechanical characteristics to be determined:

- Defects available;
- Nominal diameter and cross-section area;
- Strength limits at axial tension;
- Elasticity modulus;
- Limit stress at cross-section shear;
- Strength limit at compression;
- Strength limit of B25 concrete bond (pull-out method).
- Alkali resistance of CRC:
  Strength limit at axial tension (under scheme A);
  Strength limit of B25 concrete bond (pull-out method) -
  (under scheme B).

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Reference documents for testing methods: GOST 32492 “Composite polymer reinforcement for armoring concrete structures. Methods of determining physical and mechanical characteristics”, GOST 31938-2012 “Composite polymer reinforcement for armoring concrete structures. General specifications”.

Testing equipment:

Testing machine УММ-10, factory No.862, verification certificate No.33185/15 valid until 30.12.2016;

Vernier caliper ШЦЦ-1-300-0,01, factory No. 12083978, verification certificate No.5539 valid until 20.08.2016;

Mechanical stopwatch СОПр-2а-3-000 factory No.5636, verification certificate No.5044/15 valid until 21.05.2016;

Measuring steel bar No.20048-00, note in the passport valid until 14.09.16;

Lab scales ВК-600 factory No.005776, verification certificate No.11639/15 valid until 07.07.2016

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TEST RESULTS

I APPEARANCE

Test date - 29.02.2016 and 29.04.2016. External appearance control is given in table 1.

Table 1— Appearance

Name of the defect	Results of external appearance inspection
Chips	Not detected
Splitting	Not detected
Cavities	Not detected
Tears with winding breaks	Not detected
Dents caused by mechanical stress with fiber damaging	Not detected

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II DETERMINATION OF NOMINAL DIAMETER

- Sample tagging – fiberglass reinforcement of AKC 08 mm grade;
- Name of organization conducting the tests – TC Ural NIIStrom, LLC;
- Test date - 18.12.2015;
- Test conditions – temperature of 24°C, humidity of 25%;

Nominal diameter and cross-section areas of deformed composite fiberglass reinforcement of 8 mm diameter is given in table 2.

Table 2 – Nominal Diameter and Cross-section Area

Sample No.	Sample length, mm	Mass, g		Nominal diameter, mm		Cross section area, mm^2	
		In air	In water	Single	Average	Single	Average
1	196,1	19,99	9,97	8,07	8,06	51,12	51,06
2	195,5	20,07	9,96	8,12		51,76	
3	195,1	19,87	10,04	8,01		50,37	
4	196,6	19,99	10,00	8,05		50,87	
5	194,3	19,94	9.96	8,09		51,38	
6	193,0	19,71	9.90	8.05		50,87	

III TESTS FOR AXIAL TENSION

Test date - 24.02.2016 and 29.04.2016.

Results of tests for axial tension of composite fiberglass reinforcement are given in table 3 and figures 1-5.

Table 3 – Strength Limit for Axial Tension of Composite Fiberglass Reinforcement

Sample No.	Nominal diameter, mm	Cross-section area, mm ^{2}	Max.load, kgf	Strength limit, MPa		Elasticity modulus, MPa		Relative extension, %	
				Single	Average	Single	Average	Single	Average
1	8,07	51,12	4040	775	1110	48436	51449	2,22	2,04
2	8,12	51,76	6180	1171		54801		2,06	
3	8,01	50,37	6180	1203		53243		1,96	
4	8,05	50,87	5945	1146		48425		2,08	
5	8,09	51,38	6040	1153		49410		1,90	
6	8,05	50,87	6300	1215		54381		2,03	

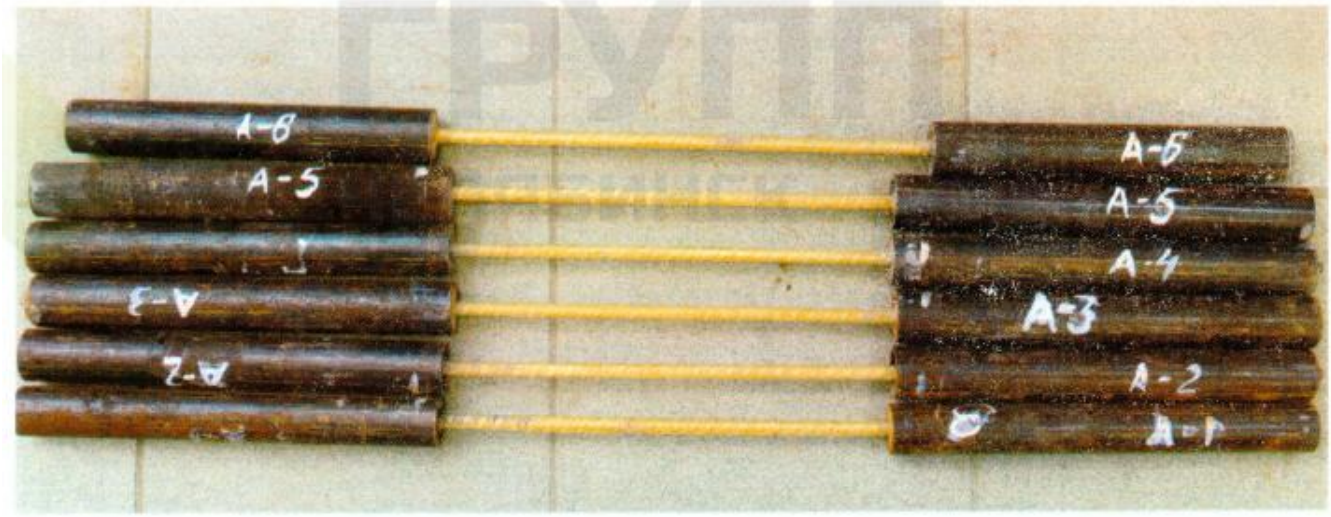

Figure 1 – Composite Fiberglass Reinforcement before Tests for Axial Tension

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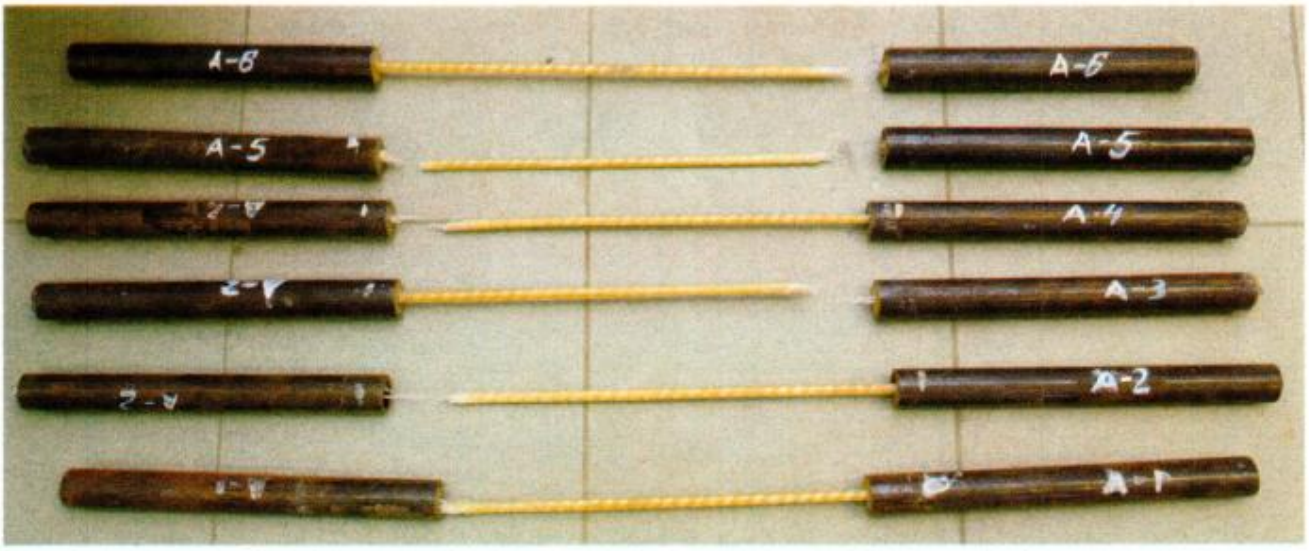

Figure 2 - Composite Fiberglass Reinforcement after Tests for Axial Tension

Figure 3 – Course of Testing of Composite Fiberglass Reinforcement for Axial Tension

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Table 4 – Strength Limit for Axial Tension of Composite Fiberglass Reinforcement after Alkali Medium Exposure under Scheme A

Sample No.	Nominal diameter, mm	Cross-section area, mm^2	Max. load, kgf	Strength limit, MPa	
				Single	Average
7	8,07	51,12	3930	754	834
8	8,12	51,76	4780	906	
9	8,01	50,37	4190	816	
10	8,05	50,87	4640	894	
11	8,09	51,38	4220	806	
12	8,05	50,87	4300	829	

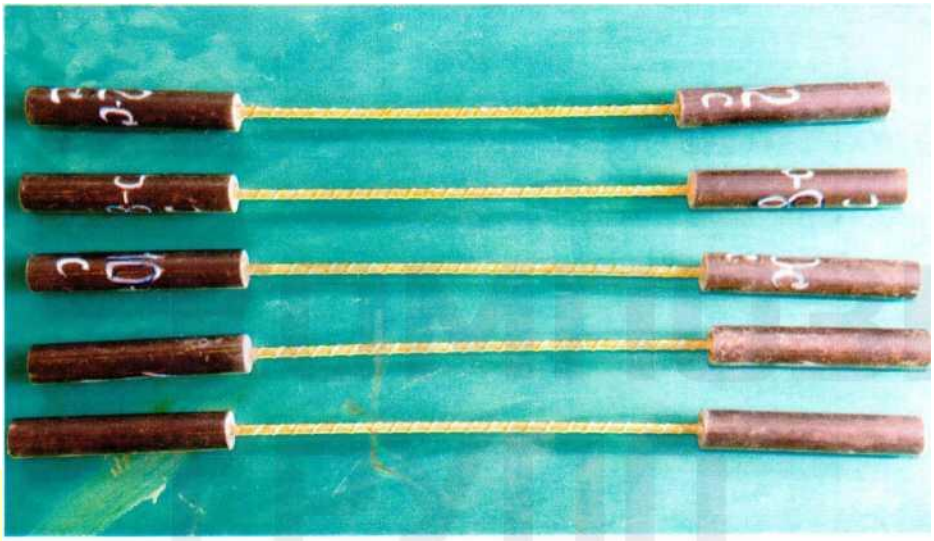

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Figure 4 – Composite Fiberglass Reinforcement before Tests for Axial Tension after Alkali Medium Exposure under Scheme A

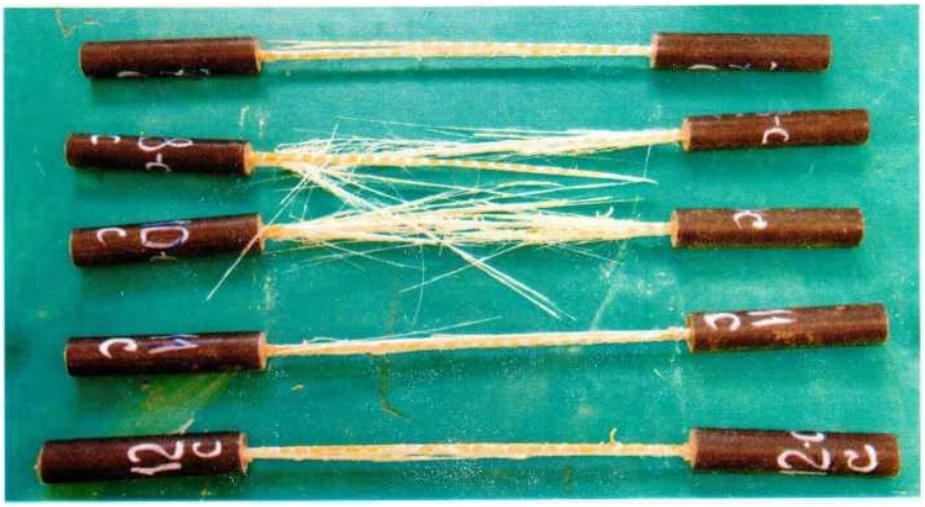

Figure 5 - Composite Fiberglass Reinforcement after Tests for Axial Tension after Alkali Medium Exposure under Scheme A

IV TESTS FOR COMPRESSION

Test date - 25.01.2016.

Results of tests for compression of composite fiberglass reinforcement are given in table 5 and figures 6-8.

Table 5 – Strength Limit for Compression of Composite Fiberglass Reinforcement

Sample No.	Nominal diameter, mm	Cross-section area, mm^2	Destructing load, N	Strength limit, MPa	
				Single	Average
1	8,07	51,12	38148	746,194	711
2	8,12	51,76	33539	647,983	
3	8,01	50,37	34421	683,426	
4	8,05	50,87	41286	811,596	
5	8,09	51,38	32656	635,619	
6	8,05	50,87	37756	742,196	

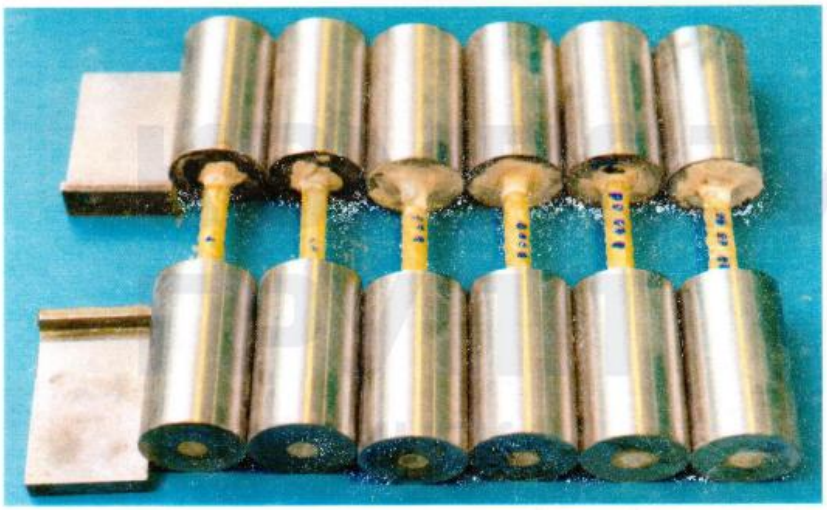

Figure 6 – Composite Fiberglass Reinforcement before Tests for Axial Compression

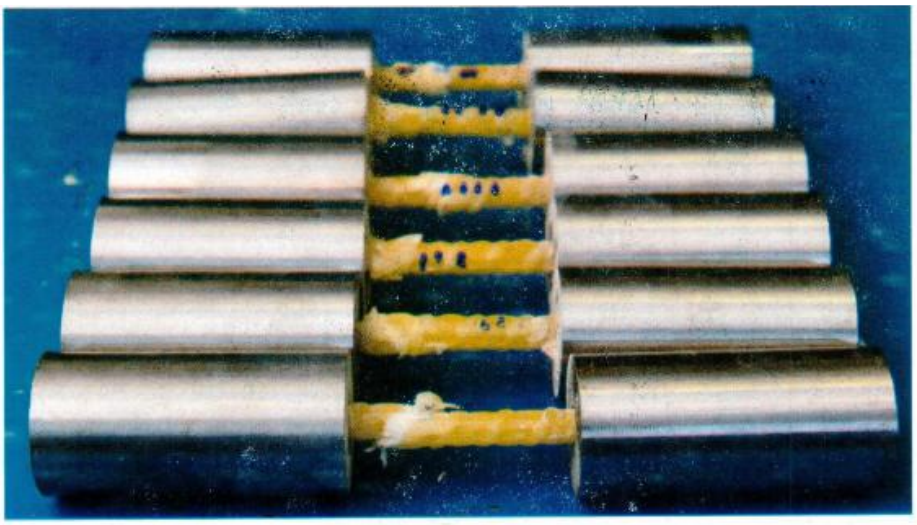

Figure 7 – Composite Fiberglass Reinforcement after Tests for Axial Compression

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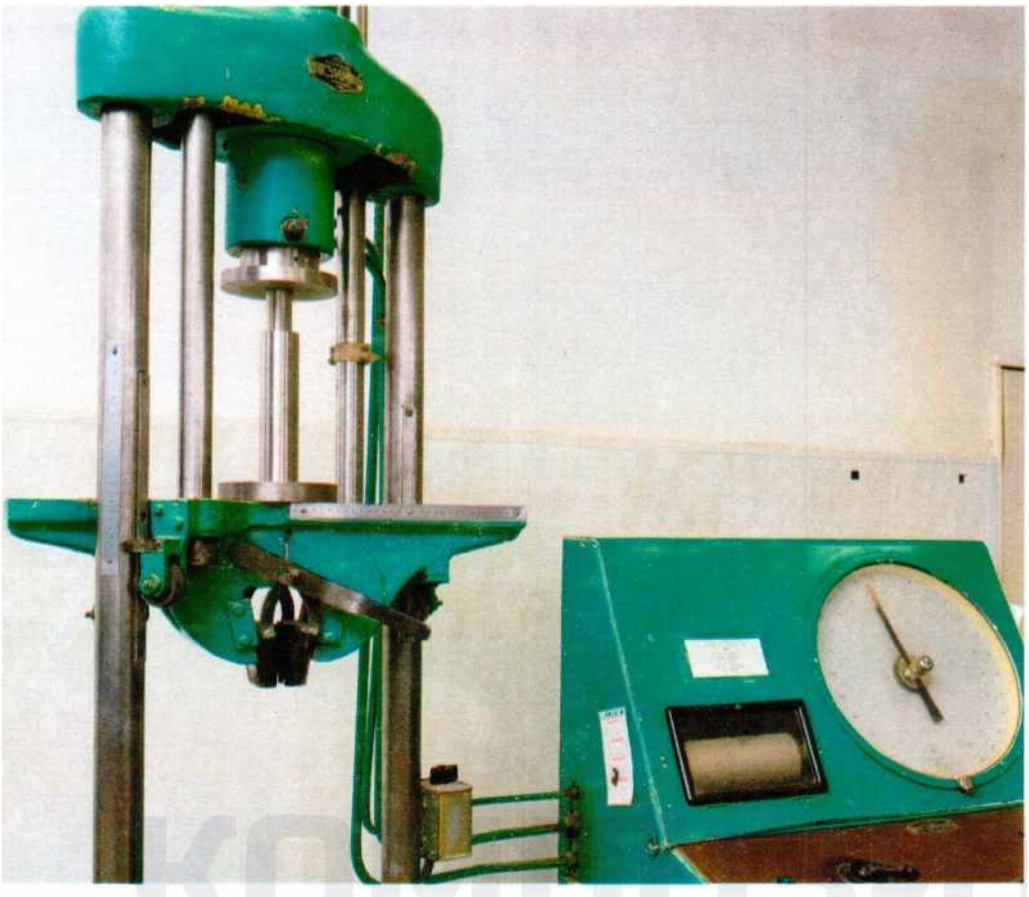

Figure 8 – Course of Testing of Composite Fiberglass Reinforcement for Axial Compression

V TESTS FOR CROSS SECTION

Test date – 01.12.2015.

Results of tests of composite fiberglass reinforcement for cross section are given in table 6 and figure 9 - 11.

Table 6 – Limit Tension at Cross Section of Composite Fiberglass Reinforcement

Sample No.	Nominal diameter, mm	Cross section area, mm^2	Destructing load, N	Limit tension, MPa	
				Single	Average
1	8,07	51,12	19613	191,816	904
2	8,12	51,76	22261	215,038	
3	8,01	50,37	24909	247,270	
4	8,05	50,87	25693	252,915	
5	8,09	51,38	22065	214,717	
6	8,05	50,87	22555	221,686	

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Appearance and nature of destruction of each sample are given in figures 8-10.

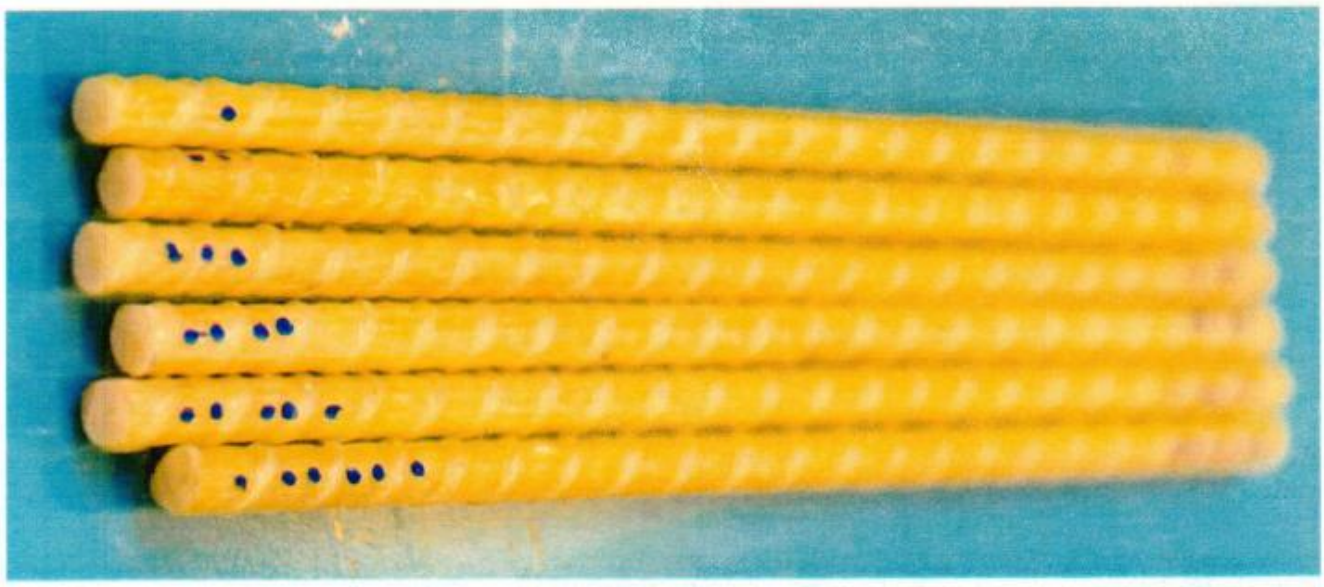

Figure 9 – Composite Fiberglass Reinforcement before Tests for Cross Section

Figure 9 – Composite Fiberglass Reinforcement after Tests for Cross Section

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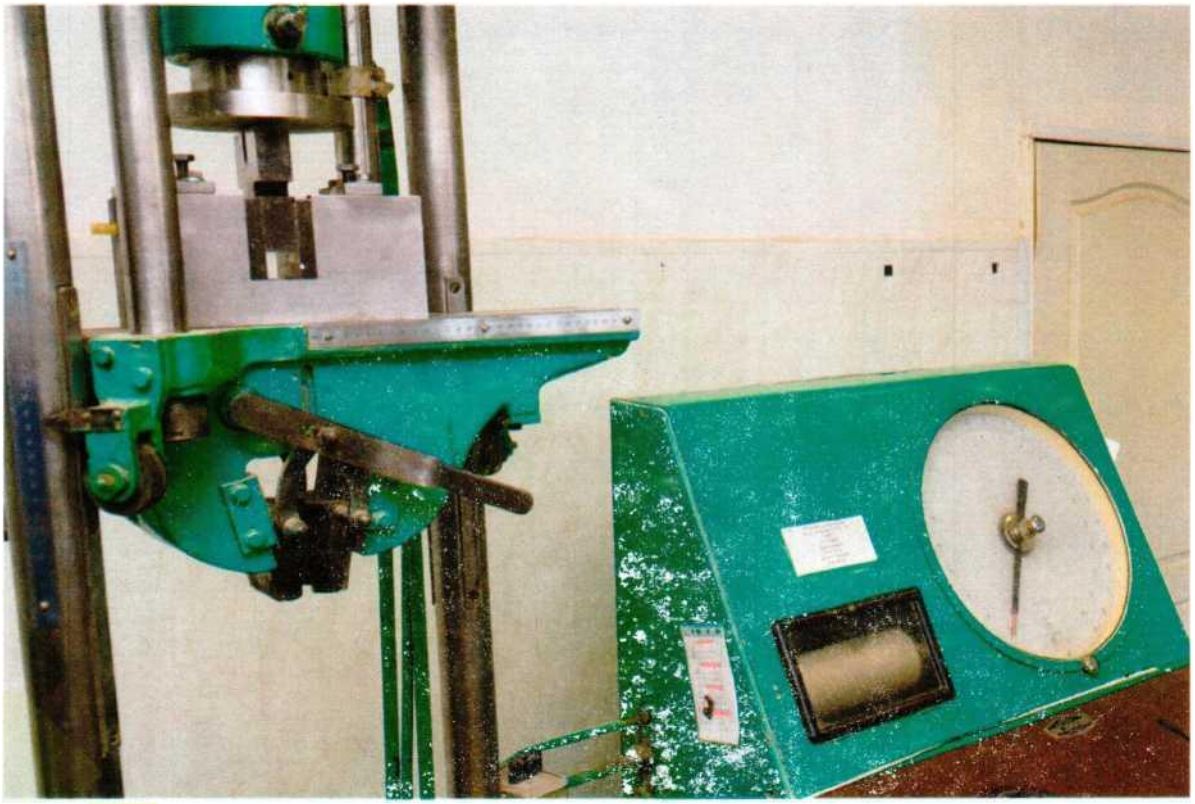

Figure 11 – Course of Testing of Composite Fiberglass Reinforcement for Cross Section

VI DETERMINATION OF STRENGTH LIMIT OF CONCRETE BOND

Test date - 18.12.2015.

Results of tests of concrete bond strength of composite fiberglass reinforcement are given in table 7, 9 and figures 12-16

Table 7 – Strength Limit of Concrete Bond Strength of Composite Fiberglass Reinforcement

Sample No.	Nominal length of rod circle, mm	Length of rod embedding in concrete, mm	Load applied, N	Concrete bond stress, MPa	
				Single	Average
1	25,34	40	24124	23,8	27,2
2	25,50	41	37265	35,6	
3	25,15	40	17064	17,0	
4	25,28	40	17652	17,5	
5	25,40	40	34127	33,6	
6	25,28	40	35892	35,5	

Data on concrete:

1. Composition of heavy weight concrete is given in table 8.

Table 8 – Composition of Heavy Weight Concrete

Materials	Consumption, kg per m
Natural sand $M_к$ over 2	865
Cement - ПЦ ЦЕМ I 42,5	550
Crushed stone of dense rock	1150
Additive СП1	2,75
Water	190

2. Mobility of concrete mixture: П3.

3. Compression strength of concrete samples at 28 days: R = 32,5 MPa. Appearance of destruction is given in figures 12-13.

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Figure 12 – Composite Fiberglass Rods before Tests of Strength Limit of Concrete Bond

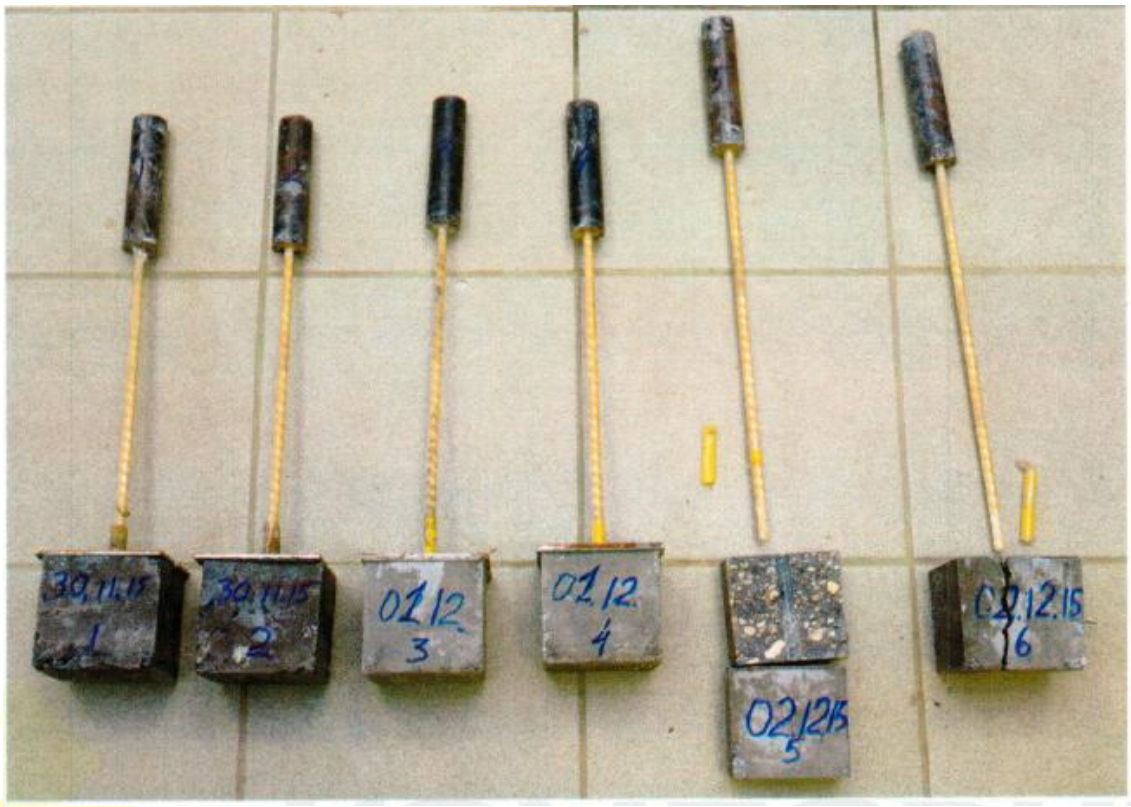

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Figure 13 – Fiberglass Rods after Tests of Strength Limit of Concrete Bond

Table 9 – Strength Limit of Concrete Bond of Composite Fiberglass Reinforcement after Alkali Exposure

Sample No.	Nominal length of rod circle, mm	Length of rod embedding in concrete, mm	Load applied, N	Concrete bond stress, MPa	
				Single	Average
1	25,34	40	14318	14,1	10,9
2	25,50	40	9611	9,4	
3	25,15	40	8826	8,8	
4	25,28	40	10297	10,2	
5	25,40	40	11376	11,2	
6	25,28	40	11768	11,6	

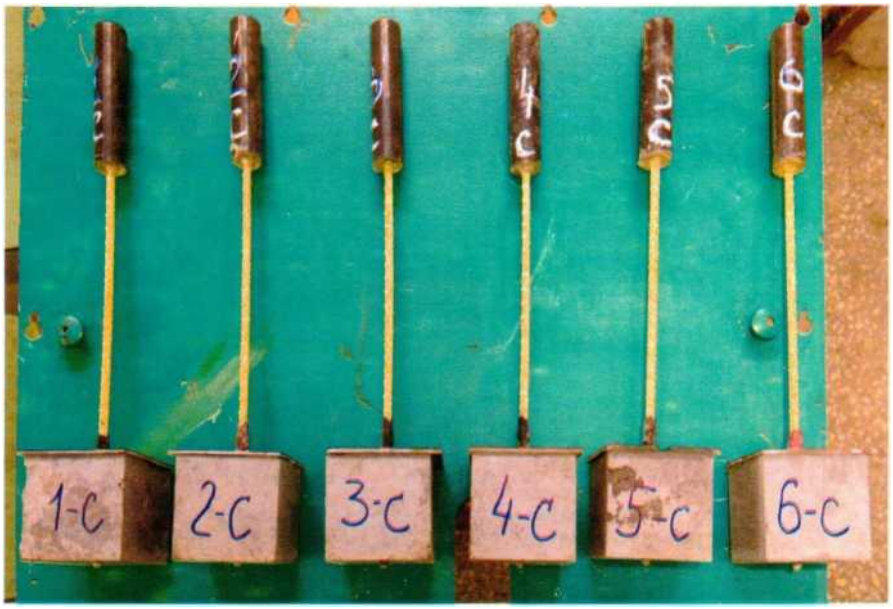

Figure 14 – Composite Fiberglass Reinforcement before Tests of Strength Limit of Concrete Bond after Alkali Exposure

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Figure 15 - Composite Fiberglass Reinforcement after Tests of Strength Limit of Concrete Bond after Alkali Exposure

Figure 16 – Course of Testing of Concrete Bond Strength Limit of Fiberglass Rods

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CONCLUSION BASED ON THE RESULTS OF CONDUCTED TESTS OF COMPOSITE FIBERGLASS REINFORCEMENT

Table 10 – Physical and Mechanical Indicators

Item No.	Name of indicator, measurement unit	Results of tests conducted	Norm per GOST 31938-2012
1	Defects available	Not detected	Not allowed
2	Nominal diameter, mm	8,06	No less than 8
3	Density, g/cm^{-3}	2,00	n/a
4	Strength limit at tension, MPa	1110	No less than 800
5	Elasticity modulus, GPa	51	No less than 50
6	Strength limit at tension (after alkali medium exposure), MPa	834	-
7	Decrease of strength limit at tension after alkali medium exposure	24,9%	No more than 25%
8	Strength limit at compression, MPa	711	No less than 300
9	Strength limit at cross section, MPa	224	No less than 150
10	Strength limit of concrete bond, MPa	27,2	No less than 12
11	Strength limit of concrete bond (after alkali medium exposure), MPa	10,9	No less than 10

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Conclusion: The tested samples of deformed composite fiberglass reinforcement of AKC grade of 8 mm diameter by the indicators listed in Table 8 comply with the requirements of GOST 31938-2012 “Composite polymer reinforcement for armoring concrete structures. General specifications”.

Note 1. Test results include the tested samples only.

Note 2. Full or partial reproduction of the present Report is allowed under a permit of the Head of the TC UralNIIStrom only.

Примечание I

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0091516

ACCREDITATION CERTIFICATE OF TESTING ABORATORY (CENTER)
NO. POCC RU 0001 517489

Name of Organization Limited Liability Company
Ural Scientific and Research Institute of Construction Materials OGRN (Primary State Registration Number 1047423005519
454047, Chelyabinsk, Stalevarov str., 5
Hereby approves that Testing Center
454047, Chelyabinsk, Stalevarov str., 5
Complies with the requirements of GOST R ISO/MEK 17025 2009

Certified as technical competent and independent

For performance of testing activities in accordance with the field of certification.
The field of certification is defined in Appendix hereto and is its integral part.

L.S.
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Certification period is effective from October 09, 2012 throughout October 09, 2017

Head (Deputy Head) of Certifying Entity S.V. Migin

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