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Sample ID : **Fiberglass rebar 8 mm**
Fiberglass rebar 10 mm
Fiberglass rebar 13mm

	TEST	DIRECTIVE	METHOD	RESULT
*	Fibre-reinforced polymer (FRP) reinforcement of concrete — Test methods — Part 1: FRP bars and grids	The General Product Safety Directive (GPSD) (2001/95/EC)	ISO 10406-1	See Tables

NOTE: This test/inspection result replaces the conformity assessment, can be presented to official institutions, and used in products and brochures.



Seal

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Test results, methods and other information about the sample shown in the relevant pages of this Report are based on the information specified in accordance with "Test Request Form (PR03-F01) conveyed to us from the Applicant. Test results are valid for the sample as identified above. Sample may not represent the lot which it belongs. This Report does not replace a Product Certificate. Full report or any part of it may not be reproduced or used for any other purpose without the written permission of EUROLAB Laboratory. Sampling has not been done by us. Unsigned and unsealed Reports are invalid. Analysis as indicated with "*" are in the Scope of our Accreditation Certificate issued from UAF according to TS EN ISO/IEC 17020, 17025, Analysis as indicated with "***" are performed at the external laboratories using accredited test methods according to EN ISO/IEC 17020, 17025 from UAF. Possible extra notes may add with starting N¹ to related pages. Tested and remaining samples will be keep in specified terms & conditions at test request and/or proposal form. Physically, chemically and microbiologically decomposed samples are discarded regardless of the storage period. Applicant can not claim any right in this regard. Results are shown in this Report do not include Measurement Uncertainty values. Measurement Uncertainty values are not taken in consideration during Pass/Fail assessment the of test results shown in this Report. Evaluation of the test results using Measurement Uncertainty values is the responsibility of the Applicant.

PR33-F01/08.10.2015/Rev:17.01.2017-R01

ISO 10406-1: Fibre-reinforced polymer (FRP) reinforcement of concrete — Test methods — Part 1: FRP bars and grids

Scope

This part of ISO 10406 specifies test methods applicable to fibre-reinforced polymer (FRP) bars and grids as reinforcements or pre-stressing tendons in concrete.

Test method for cross-sectional properties

Nominal diameter:8mm-10mm-13mm

Length:100mm

Number of test pieces:3

Test method

The test procedure is as follows.

- a) Measure the length of the test piece using the vernier callipers in accordance with ISO 13385-1. Measure a part and record the result to three places; round off the three averaged values to one place after the decimal point. Take this as the length of the test piece.
- b) Measure the volume of the test piece using a measuring cylinder in accordance with ISO 4788:2005, type 1a or 1b (class A or class B), according to the approximate diameter of the test piece. Table 2 shows the relationship between the approximate diameter of the test piece and the capacity of the measuring cylinder. When two capacities are listed, choose the smaller-capacity cylinder for that range.
- c) Add the proper quantity of water to the measuring cylinder and measure the volume. When the test piece is in the measuring cylinder, the water should cover the test piece and the top of the water shall be in the range of scale.
- d) Insert the test piece into the measuring cylinder and measure the volume of the combined water and the test piece.
- e) The test temperature shall be within the range of 15 °C to 25 °C. The temperature range of 20 °C to 30 °C is applicable for warm countries.

Test Result

Diameters of test pieces (mm)	Measured nominal cross-sectional area (A)	D(mm) Average
Fiberglass 8 mm	50.2	8.66
Fiberglass 10 mm	78.5	10.01
Fiberglass 13 mm	132.7	13.02

Test method for tensile properties

Test method

Mounting of the test piece

Mount the test piece on the testing machine, such that only the axial load is transmitted.

Mounting of extensometer

Mount the extensometer along the axis of the central portion of the test piece.

Loading method

Carry out the loading in accordance with the following requirements.

- Apply the load at a constant rate without impact to the test piece. The rate of loading shall be 0,5 % to 1,5 % strain per minute. The test time shall not exceed 5 min.
- Measure the strain at not fewer than 10 equally spaced loading increments until approximately two thirds of the maximum tensile force.
- Record the maximum tensile force with a precision of three significant digits.

Test temperature

The test temperature shall be within the range of 5 °C to 35 °C.

Sample No.	Tensile strength [MPa]	Tensile rigidity [kN]	Young's modulus [GPa]
8 mm-1	969.2	1692	47,2
8 mm 2	1083.8	1729	44,8
8 mm 3	1266.1	1745	43,9
8 mm 4	1047.5	1809	45,4
8 mm 5	1287.9	1710	40,6
10 mm-1	1312.7	2891	50,7
10 mm -2	1351.0	3345	48,4
10 mm -3	1331.9	3840	51,9
10 mm -4	1227.8	3456	49,6
10 mm -5	1254.2	3678	49,1
13 mm-1	1182.8	5023	59,2
13 mm -2	1243.6	5584	57,4
13 mm -3	1215.4	5874	55,3
13 mm -4	1096.4	5148	61,0
13 mm -5	1177.6	6001	55,6

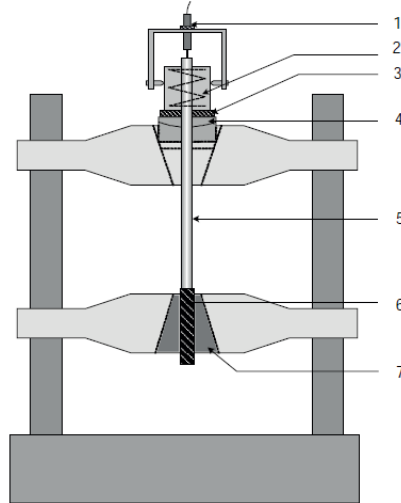
Test method for bond strength by pull-out testing

Test method

- **Mounting of test pieces**

Place the test piece correctly on the loading plate with a spherical plate underneath to prevent eccentric loads from acting on the test pieces.

- 1 LVDT
- 2 concrete prism
- 3 loading plate
- 4 spherical plate
- 5 FRP rod
- 6 anchoring section
- 7 anchoring device



Outline of bond test (pull-out test)

- **Loading rate**

The standard loading rate shall be such that the average tensile stress of the FRP bar increases at a rate of 10 N/mm²/min to 20 N/mm²/min. Keep the loading rate as constant as possible so as not to subject the test pieces to shock.

- **Scope of test**

The slippage of the free end and the load applied shall be recorded in increments as shown in Table 4, until either the FRP bar pulls out of the concrete or the load decreases significantly due to the splitting or cracking of the concrete.

Table 4 — Measurement increments

Slippage of free end mm	Measurement increment mm
<0,1	0,01
0,1 to 0,2	0,02
0,2 to 0,5	0,05
>0,5	0,1

- **Age of test pieces**

The age of the test pieces at the time of testing shall be 28 days.

Test Result

Sample No.	Maximum Force (N)	Bonded Length (mm)	Nominal Peripheral Length (mm)	Pull out displacement of bar (mm)	Bond strength by pull-out testing [N/mm ²]	Average
8 mm-1	5921	26,85	20,97	0,71	8,99	10,57
8 mm 2	6993			0,96	12,21	
8 mm 3	5596			0,81	10,51	
10 mm-1	12196	40,08	31,79	1,35	10,46	11,79
10 mm -2	14503			1,50	13,55	
10 mm -3	17511			1,42	11,38	
13 mm-1	25699	58,61	42,55	2,89	13,92	14,08
13 mm -2	30165			2,92	14,02	
13 mm -3	35248			3,02	14,31	

Test method for tensile fatigue**Test method**

- **Mounting of test pieces**

Mounting of test pieces shall be in accordance with the provisions .

- **Load setting**

For the purpose of determining an *S-N* curve, set the maximum and minimum loads by one of the following three methods.

- Fix the average load and vary the load amplitude.
- Fix the minimum load and vary the maximum load.
- Fix the load ratio and vary the maximum and minimum load according to this fixed ratio.

Determine the method adopted according to the purpose of the test. In any case, at least three load levels shall be set such that the range of number of cycles to failure is between 103 to 2×10^6 . Typical *S-N* curves for FRP materials to utilize a fixed load (stress) ratio, *R*, of 0,1.

- **Frequency**

The frequency should normally be within the range of 1 Hz to 10 Hz.

- **Start of test**

After static loading up to the average load, commence repeated loading. Introduce the prescribed load rapidly and without any shock. The maximum and minimum repeated loads shall remain constant for the duration of the test. Counting of the number of cycles should normally commence when the load on the test piece has reached the prescribed load.

- **End of test**

Complete separation (breaking) of the test piece shall be deemed to constitute failure; record the number of cycles to failure. If the test piece does not fail after 2×10^6 cycles, the test may be discontinued. Do not reuse test pieces that did not fail.

- **Interruption of test**

Tests should normally be conducted without interruption for each test piece from the start to the end of the test. When a test is interrupted, record the number of cycles up to the time of interruption and the period of the interruption.

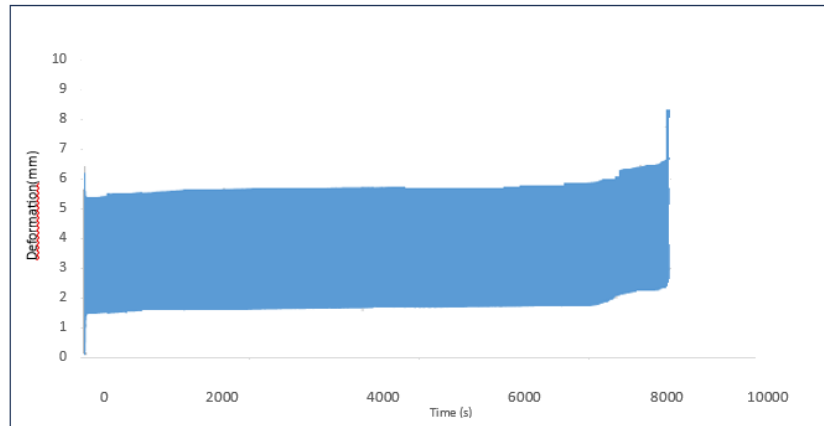
Test Result

Range of minimum and maximum load cycle: 4-18 kN

Cycle frequency: 0,5 Hz

Maximum number of cycles: 4201

Sample: 8 mm

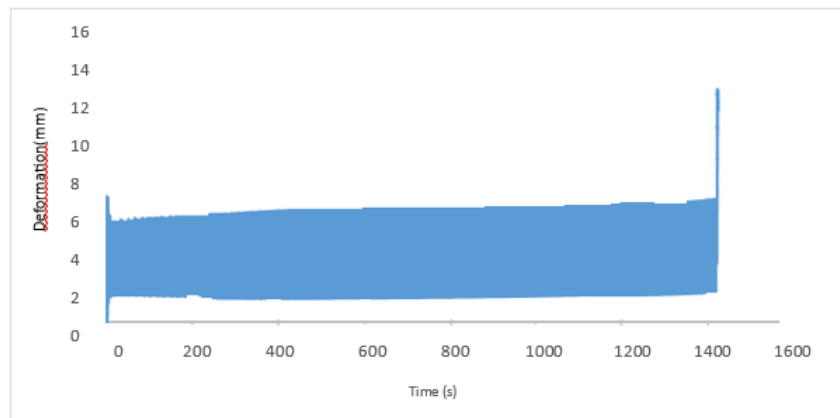


Range of minimum and maximum load cycle: 5-50 kN

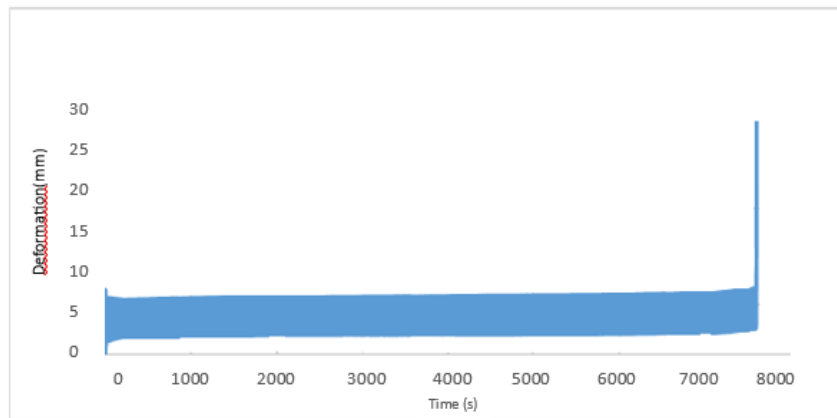
Cycle frequency: 0,4 Hz

Maximum number of cycles: 722

Sample: 10 mm



Range of minimum and maximum load cycle: 5-45 kN
 Cycle frequency: 0,3 Hz
 Maximum number of cycles: 1358
 Sample:13 mm



Test method for alkali resistance

Test Parameters

Preparation of alkaline solution

The solution should have an initial pH above 13.

For example, the composition of the alkaline solution consists of 8,0 g of NaOH and 22,4 g of KOH in 1 l of deionized water.

Immersion temperature

60 °C ± 3 °C

Period of immersion

One month

Test Result

Sample No.	Tensile strength [MPa]	Tensile rigidity [kN]	Young's modulus [GPa]
8 mm-1	859.3	1461	42,6
8 mm 2	860.6	1521	44,8
8 mm 3	831.4	1823	55,1
8 mm 4	512.9	1395	39,0
8 mm 5	909.3	1678	48,2
10 mm-1	1039.0	2698	35,0
10 mm -2	1158.1	4064	50,9
10 mm -3	1044.4	3326	41,1
10 mm -4	1176.7	4581	54,8
10 mm -5	1193.8	4067	52,3
13 mm-1	1099.6	4632	51,1
13 mm -2	1189.3	5028	49,4
13 mm -3	1147.1	4983	63,0
13 mm -4	1063.1	5123	55,4
13 mm -5	1204.6	5385	60,6

Test method for transverse shear strength

Test method

- **Mounting of test piece**

Mount the test piece in the centre of the shear apparatus, touching the upper loading device. No gap should be visible between the contact surfaces of the loading devices.

- **Loading rate**

The specified loading rate shall be such that the shearing stress increases at a rate of 30 N/mm²/min to 60 N/mm²/min. Apply loading uniformly without subjecting the test piece to shock.

- **Scope of test**

Continue loading until the test piece fails. Record the failure load with a precision of three significant digits. It should be noted that loading can decrease temporarily due to the presence of two rüptüre faces.

Test Result

Sample No.	Shear strength at rupture (N)	Shear strength (N/mm ²)	Average
8 mm-1	20,291	295,49	308.73
8 mm 2	19,501	280,75	
8 mm 3	22,998	332,04	
8 mm 4	21,269	310,28	
8 mm 5	22,618	325,12	
10 mm-1	41,572	268,19	268,57
10 mm -2	42,420	271,05	
10 mm -3	39,392	255.37	
10 mm -4	41,958	275.24	
10 mm -5	41,872	273,01	
13 mm-1	62,482	249,21	234,33
13 mm -2	61,321	230,01	
13 mm -3	60,217	228,89	
13 mm -4	61,258	231,43	
13 mm -5	61,741	232,14	

*** End of Report***