ASLAN™ 100

GLASS FIBER REINFORCED POLYMER (GFRP) REBARS FOR **INFRASTRUCTURE SOLUTIONS**

PHYSICAL & MECHANICAL PROPERTIES

Nominal Diameter			Nominal Area		f^*_{fu} Garanteed Tensile Strength		Ultimate Tensile Load		E_f Tensile Modulus of Elasticity		Ultimate Strain
Size	mm	in	mm²	in²	MPa	ksi	kN	kips	GPa	psi 10^6	%
2	6	1/4	31.67	0.049	896	130	28.34	6.37	46	6.7	1.94%
3	10	3/8	71.26	0.110	827	120	58.72	13.20	46	6.7	1.79%
4	13	1/2	126.7	0.196	758	110	95.90	21.56	46	6.7	1.64%
5	16	5/8	197.9	0.307	724	105	143.41	32.24	46	6.7	1.57%
6	19	3/4	285.0	0.442	690	100	196.60	44.20	46	6.7	1.49%
7	22	7/8	387.9	0.601	655	95	254.00	57.10	46	6.7	1.42%
8	25	1	506.7	0.785	620	90	314.27	70.65	46	6.7	1.34%
9	29	1-1/8	641.3	0.994	586	85	375.83	84.49	46	6.7	1.27%
10	32	1-1/4	791.7	1.227	551	80	436.60	98.16	46	6.7	1.19%
11*	35	1-3/8	958.1	1.485	482	70	462.40	104*	46	6.7	1.04%
12*	38	1-1/2	1160	1.800	448	65	520.40	117*	46	6.7	0.97%
13*	41	1-5/8	1338	2.074	413	60	553.50	124*	46	6.7	0.90%

*Tensile properties of #11, #12 & #13 bar are NOT guaranteed due to the inability to achieve a valid bar break per ASTM D7205.

We reserve the right to make improvements in the product and/or process which may result in benefits or changes to some physical-mechanical characteristics. The data contained herein is considered representative of current production and is believed to be reliable and to represent the best available characterization of the product as of July 2011. Tensile tests per ASTM D7205.

DESIGN TENSILE & MODULUS PROPERTIES per ASTM D7205-06

The area used in calculating the tensile strength is the nominal cross sectional area. The "Guaranteed Tensile Strength", f^*_{fu} is as defined by ACI 440.1R as the mean tensile strength of a given production lot, minus three times the standard deviation or $\mathbf{f^*_{fu} = f_{u,ave} - 3\sigma}$. The "Design or Guaranteed Modulus of Elasticity is as defined by ACI 440.1R as the mean modulus of a production lot or $\mathbf{E_f = E_{f,ave}}$.

CROSS SECTIONAL AREA TOLERANCE -0% / +20%

Design properties are determined using "Nominal" diameters and equivalent calculated cross sectional areas. Surface undulations and sand coatings that facilitate bond are accommodated for in ASTM D7205, section 11.2.5, with a tolerance of minus zero, plus 20% as determined by the Archimedes method of volume displacement in a fluid.

BOND DEPENDED COEFFICIENT $k_b = 0.9$ per ASTM draft test method. As used in ACI equation 8-9.

GLASS FIBER CONTENT > 70% by weight per ASTM D2584

TRANSVERSE SHEAR STRENGTH > 22,000 PSI (150MPA) per ASTM D7617 & ACI 440.3R method B.4

VOID CONTENT No Continuous Voids after 15 minutes of capillary action, per ASTM D5117

MOISTURE ABSORPTION 24 hour absorption at 122°F (50°C) ≤ 0.25%, per ASTM D570

MATERIAL CERTS & TRACEABILITY

Available for any production lot of Aslan™ 100 bar, traceable by bar marks imprinted on the bar in intervals showing the bar diameter, stock order and production date.

DENSITY

Nominal Diameter			Unit Weight/length	
Size	mm	in	kg/m	lbs/ft
2	6	1/4	0.0774	0.052
3	10	3/8	0.0159	0.107
4	13	1/2	0.2813	0.189
5	16	5/8	0.4271	0.287
6	19	3/4	0.6072	0.408
7	22	7/8	0.8096	0.544
8	25	1	1.0462	0.730
9	29	1-1/8	1.4137	0.950
10	32	1-1/4	1.7114	1.15
11*	35	1-3/8	1.9346	1.30
12*	38	1-1/2	2.4554	1.65
13*	41	1-5/8	2.8721	1.93

BENT BARS & STIRRUPS

Must be made at the factory, field bending not permitted. Industry standard bent shapes are available, standard shape codes are used.

Some limitations include:

- Max leg length of a stirrup is 60" (152cm)
- Redirection of bends, such as Z-shapes or gull-wings types are not very economical. Bent shapes should continue in the same circular direction
- Closed square shapes are best furnished as pairs of U-bars or continuous spirals
- A 90-degree bend with 12db, bar diameter, pigtail used to shorten development length is equally as effective as a J-shape as per ACI 440.1R
- The radius on all bends is fixed as per the table shown. Some Ushaped stirrups fall in between the range of these two bend radiuses and are not possible

We advise that you work closely with the factory to implement the most economical detailing of bent bars and stirrups.

FIELD FORMING OF LARGE RADIUS CURVES

Permitted when the radius is larger than in the following table. The table gives the minimum allowable radius for induced bending stresses without any consideration for additional sustained structural loads.

CHARACTERISTIC PROPERTIES

Characteristic Properties are those that are inherent to the FRP bar and not necessarily measured or quantified from production lot to production lot.

- **Strength of the Bent Portion of the Bar** > 50% strength of the straight length of the bar, per ACI 440.3R method B.5
- **Durability – Alkali Resistance ~ without load** > 80% of the straight length of the bar, per ACI 440.3R method B.5
- **Tensile Strength at Cold Temperature** < 5% strength reduction from ambient at -40°F (-40°C), per ASTM D7205
- **Transition Temperature of Resin T_g** > 230°F (110°C) per DSC method

BEND RADIUS

Nominal Diameter			Inside Bend Radius	
Size	mm	in	mm	in
2	6	1/4	38	1.5
3	10	3/8	54	2.125
4	13	1/2	54	2.125
5	16	5/8	57	2.25
6	19	3/4	57	2.25
7	22	7/8	76	3.0
8	25	1	76	3.0

Nominal Diameter			Interior Use C_e = 0.8 min Radius		Exterior Use C_e = 0.7 min Radius	
Size	mm	in	cm	in	cm	in
2	6	1/4	107	42	122	48
3	10	3/8	170	67	196	77
4	13	1/2	246	97	282	111
5	16	5/8	323	127	368	145
6	19	3/4	404	159	462	182
7	22	7/8	495	195	566	223
8	25	1	597	235	678	267
9	29	1-1/8	597	280	813	320
10	32	1-1/4	711	343	996	392
11*	35	1-3/8	871	414	1204	474
12*	38	1-1/2	1052	487	1412	556
13*	41	1-5/8	1237	570	1656	652

HANDLING & PLACEMENT

Follow guidelines in ACI440.5-08 "Specification for Construction with FRP Bars". In general, field handling and placement is the same as for epoxy or galvanized steel bars. Do NOT shear FRP bars. When field cutting of FRP bars is necessary, use a fine blade saw, grinder, carborundum or diamond blade. Sealing the ends of FRP bars is not necessary. Support chairs are required at two-thirds the spacing of steel rebar. Plastic coated tie wire is the preferred option for most projects. When completely non-ferrous reinforcing, i.e., no steel is required in the concrete, nylon zip ties (available from local building materials centers) or plastic bar clips are recommended. (Don't forget to use non-metallic form ties in formwork.) It is possible, especially in precast applications, for GFRP bars to "float" during vibrating. Care should be exercised to adequately secure GFRP in the formwork.

AMERICAS

Owens Corning
Composite Materials, LLC.
One Owens Corning Parkway
Toledo, OH 43659
1-800-GET-PINK™

EUROPE

European Owens Corning Fiberglas Sprl.
166 Chaussée de la Hulpe
B-1170 Brussels
Belgium
+32 2 674 8211

ASIA PACIFIC

Owens Corning Composite Solutions Business – Asia Pacific Regional Headquarters
40/F, Pudong Kerry Parkside,
1155 Fang Dian Road, Pudong,
Shanghai, 201204, China
+86-21-6101 9666

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