FRP REBAR

Product Data Sheet

Physical / Mechanical Properties – Tensile, Modulus & Strain

Nominal Diameter		Nominal Area		f*fu – Guaranteed Tensile Strength		Ultimate Tensile Load		Ef – Tensile Modulus of Elasticity		Ultimate Strain	
Size	mm	in	mm^2	in^2	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

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 $\mathbf{E_f = E_{f,ave}}$.

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.

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.

Density

Diameter				Length/Weight	
Size	mm	in		kg / m	lbs / ft
2	6	1/4		0.0774	0.052
3	10	3/8		0.159	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

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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 U-shaped stirrups fall in between the range of these two bend radiuses and are not possible.

Bend Radius

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

** 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.

Strength of the Bent Portion of the Bar

…. > 50% strength of the straight length of the bar, per ACI 440.3R method B.5

Density

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		711	280		813	320
10	32	1-1/4		871	343		996	392
11	35	1-3/8		1052	414		1204	474
12	38	1-1/2		1237	487		1412	556
13	41	1-5/8		1448	570		1656	652

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.

Durability – Alkali Resistance ~ without load

…. > 80% strength retention, when exposed to 12.8pH solution for 90 days at 140°F (60°C)

Tensile Strength at Cold Temperature

…. < 5% strength reduction from ambient at -40°F (-40°C), per ASTM D7205.

Transition Temperature of Resin - Tg

…. > 230°F (110°C) per DSC method

Handling and 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.

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