

1 Make the following Section a part of the Standard Specifications:

2
3 **"SECTION 670 - GLASS FIBER REINFORCED POLYMER REBAR**

4
5 **670.01 Description.** This work includes the furnishing and placing of Glass
6 Fiber Reinforced Polymer (GFRP) Rebar according to the contract.

7
8 **670.02 Materials.** Materials and construction for the GFRP rebars shall
9 conform to ACI 440.1 R-01 "Guide for the Design and Construction of Concrete
10 Reinforced with FRP Bars". GFRP rebars shall also meet the following
11 conditions and properties:

12
13 Tensile Strength: 110,000 psi, min. for #4 bar; 95,000 psi, min. for
14 #5 bar.

15
16 Modulus of Elasticity: 6,700,000 psi, min.

17
18 Barcol Hardness: 60 min.

19
20 Bond stress between the rebar and concrete shall exceed 1500 psi.

21
22 Glass content by weight: 70% min. Per ASTM D2584.

23
24 The product shall be non-magnetic, non-conducting and corrosion
25 resistant. The use of ferrous materials is prohibited. The product shall exhibit
26 chemical resistance to salts, acids and concrete chemistries.

27
28 (A) Materials shall be obtained from a manufacturer regularly engaged
29 in the production of GFRP rebars. Six copies of the manufacturer's
30 brochures shall be submitted.

31
32 (B) A copy of the manufacturer's Quality Assurance Manual shall be
33 provided prior to delivery of any product to the site.

34
35 (C) Tensile test reports from the manufacturer shall be provided for
36 every 3,000 feet of product supplied in accordance with ASTM D-3916-84.

37
38 (D) Assigned Lot traceability numbers from the manufacturer with each
39 shipment shall be provided. These numbers shall change with each
40 production shift.

41
42 (E) Daily resin impregnation test results shall be provided at the
43 request of the Engineer.

44
45 (F) Certified test results of material properties shall be provided.

46
47 **670.03 Construction Requirements.**

48
49 **(A) General.**
50

51 **(1) Straight Bars.** All GFRP reinforcing bars shall consist of
52 uniformly pretensioned continuous longitudinal fibers encapsulated
53 in the matrix material. The outer surface shall be deformed by a
54 helical wrap of glass and sand coating providing a mechanical bond
55 between the bar and concrete. The GFRP reinforcing bars shall
56 not be cut or taken from the production line until an initial curing
57 state has been reached and the bars exhibit dimensional stability.
58

59 **(2) Fabricated Bends.** All bends shall be fabricated in the
60 factory and straight thermal curing shall not take place until all
61 fabrication has been completed. Such fabrication shall always be
62 executed with the use of molds. Each radius shall transfer no less
63 than 40% of ultimate tensile strength. ACI 318 minimum radius
64 shall be adhered to unless otherwise permitted by the Engineer.
65 Field bends shall not be permitted.
66

67 **(B) Installation.** The product shall be field cut with masonry blades.
68 A dust mask or other suitable protection shall be used during the cutting
69 process.
70

71 **(C) Order Lists and Bending Diagrams.** The Contractor shall
72 submit six (6) copies of the GFRP rebars order lists and bending diagrams
73 to the Engineer. The Contractor shall be wholly and completely
74 responsible for the accuracy of the lists and diagrams.
75

76 **(D) Storage, Surface Condition and Protection of Reinforcement.**
77 The Contractor shall store the GFRP rebars above the surface of the
78 ground upon platforms, skids, or other supports. GFRP rebars shall be
79 covered to protect them from ultraviolet exposure, high temperatures, and
80 chemical substances that can all deteriorate the matrix resin. The
81 Contractor shall protect the GFRP rebars from surface damage. The
82 GFRP rebars shall be free of mortar, oil, dirt, and other coatings that
83 would destroy or reduce the bond. GFRP rebars shall not be dropped on
84 the ground by workers at any time. The GFRP rebars shall also be free
85 from injurious defects including cracks and laminations.
86

87 **670.04 Measurement.** The Engineer will not measure GFRP rebars for
88 payment.
89

90 **670.05 Payment.** The Engineer will not pay for GFRP rebars
91 separately. The Engineer will consider the cost for GFRP rebars as included in
92 the contract price of various contract items in Section 602 – Reinforcing Steel.”
93

94 **END OF SECTION 670**