



Approval #

20189010

Industry Services Division
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Wisconsin Building Product Evaluation

Material

#3 GATORBAR™ Fiber Reinforced Polymer Rebar

Manufacturer

Neuvokas Corporation
PO BOX 220, 3206 #6 Road
Ahmeek, MI 49901

SCOPE OF EVALUATION

The GATORBAR™ is a basalt fiber reinforced polymer (BFRP) rebar used for temperature and shrinkage control in concrete slabs. It has been evaluated for use in accordance with the below cited International Building Code (IBC) requirements of the current Wisconsin commercial building code and Wisconsin Uniform Dwelling Code (UDC).

- **Allowable use** in design of slabs on grade or basement slabs where tensile failure is not typically an issue to be evaluated for such use of this product. Thus it may be used within designs in accordance with **s. IBC 1901.2** & structural plain concrete per **s. IBC 1906.1**.
- **Allowable use** in design of slabs on grade or basement slabs for 1- & 2-family dwellings per SPS 321.02(3)(f) as an engineered component in place of steel rebar except where **SPS 321.15(2)(e)** requires structural analysis for any dwellings on floating slab foundations.

DESCRIPTION AND USE

The #3 GATORBAR™ composite rebar is an assembly of basalt fibers reinforced in a polymer of commercial resin matrix [similar to glass-fiber reinforced polymers (GFRP)] which is used to replace steel #3 & #4 reinforcing bar or steel mesh in concrete slab-on-grade or other applications that are designed primarily for temperature & shrinkage control.

- The rebar size for most slabs is $\frac{3}{8}$ " diameter (#3 rebar) or $\frac{1}{2}$ " diameter (#4 rebar). The GATORBAR™ #3 rebar size under this approval may replace $\frac{1}{2}$ " diameter steel (#4 rebar).
- Other uses of GATORBAR™ #3 rebar may be allowed with sizing through structural analysis.

The use of Fiber Reinforced Polymer (FRP) rebar as concrete reinforcement has been increasing over the past 30 years. Due to lighter weight than steel rebar (about 7 times lighter) and zero rust property of GATORBAR™ #3 rebar; use in roads & bridge design began this product, but it is now expanding to garage slabs and other slab-on-grade applications covered by building codes.

This composite rebar is suitable for use in commercial & UDC buildings having slab-on-grade or basement slab designs within the tested loading limitations as described below.

TESTS AND RESULTS

GATORBAR™ #3 rebar data is taken from tests run by testing laboratories at University of Michigan Tech and at University of Nebraska in Lincoln, NE; as well as alkali resistance testing at Universit e de Sherbrook in Canada. Reports on GATORBAR™ #3 rebar product was provided by Neuvokas Corporation; lab accreditation was not clearly provided in those reports.

Design values from testing show that GATORBAR™ #3 rebar will meet or exceed the requirements for FRP rebar products as established by the American Concrete Institute (ACI) in ACI 440.1 and ACI 440.5 and the ASTM for FRP rebar products. Both in-house testing as quality assurance and third party testing for product verification continues to be done.

One-hundred-fifty plus specimens of GATORBAR™ #3 rebar were tested. GATORBAR™ #3 rebar data sheet values are given using three standard deviations as the safety factor for the published ultimate values shown. Testing has included ASTM D7205 for Longitudinal Tensile Strength and Modulus; ACI 440.3R-12 B.3 for Bond Properties; ASTM D7617 for Shear Strength; ASTM D7337 for Creep Properties; ACI 440.3R-12 B.6 for Durability Properties; ASTM D3479 for Fatigue Properties; ASTM E831 for Coefficient of Thermal Expansion; ASTM E1356 for Glass Transition Temperature; ASTM D570 for Moisture Absorption; and ASTM D3171 for Volume Fraction. Other tests for the following have been done, but no test standard was provided in the literature sent: Interlaminar Shear Testing, Alkaline Resistance of Fiber, and Comparative SEM Analysis.

At guaranteed tensile strength of 130 ksi, GATORBAR™ #3 rebar is over twice as strong in tension as steel rebars at 40 to 60 ksi (U.S. grade 60 steel) at a comparable price. While standard ACI 440.6-08 Specification for Carbon and Glass Fiber-Reinforced Polymer Bar Material for Concrete Reinforcement lists required strength for glass FRP rebar at 110 ksi for the #3 size.

Testing was also performed to show the GATORBAR™ #3 rebar product has a lower Modulus of Elasticity than does steel rebar, which leads to less cracking of concrete and ability to

withstand more cycles of loading & unloading than with steel #4 rebar. Ideal placement is in the midpoint to upper third of the slab for best crack control results.

Elastic properties of GATORBAR™ #3 rebar permits it to always deflect and then return to the original shape, unlike steel rebar that when loaded will experience very little elastic bending with permanent deformation after larger loading. GATORBAR™ #3 rebar can be stepped-on or even have motor vehicles drive over and it will return to the original shape; thus being held better in concrete chairs during concrete pouring with similar or less labor in placement/ties of materials.

The resulting conclusions were drawn from the literature, tests and analysis of test results:

GATORBAR™ #3 rebar Tests Results

Property	Value	Test
Guaranteed Tensile Strength	130 ksi	ASTM 7205
Ultimate Tensile Load	19,675 lbs	ASTM 7205
Tensile Modulus of Elasticity	6.7×10^6 psi	ASTM 7205
Guaranteed Transverse Shear Capacity	25.1 ksi	ASTM 7617
Moisture Content	< 0.5%	ASTM D570
Bond Strength	2,047 psi or 4,519 lbs	ACI 440.3R B3

LIMITATIONS OF APPROVAL

The **IBC** limitations below are in accordance with the current **Wisconsin Amended ICC Code**.

The GATORBAR™ #3 rebar values can be used as an alternative to #3 or #4 steel rebar as used in slab-on-grade or basement slabs in buildings.

This approval is only for the allowable design values of the GATORBAR™ #3 rebar indicated in the above conclusions shown in the TESTS AND RESULTS section.

Complete structural calculations shall be submitted for each project on a site-by-site basis when the GATORBAR™ #3 rebar are used in applications other than such slabs. Use of the GATORBAR™ #3 rebar in foundation walls and tilt-up concrete walls is beyond the scope of this approval, but is not prohibited in any way by this approval. The use of GATORBAR™ #3 rebar in upper floor above-grade slabs is beyond the scope of this approval.

GATORBAR™ #3 rebar must be installed in accordance with the manufacturer's installation recommendations.

DISCLAIMER

This approval will be valid through December 31, 2023, unless manufacturing modifications are made to the product or a re-examination is deemed necessary by the department. The Wisconsin Building Product Evaluation Number must be provided when plans that include this product are submitted for review. This approval addresses only the specified applications for the product and does not waive any code requirement not specified in this document.

Reviewed by: **Jack A.
Miller**

Approval Date: October 17, 2018 By: Jack A. Miller
Commercial building plan examiner and product reviewer