

ICC-ES Evaluation Report


ESR-4648

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<p>DIVISION: 03 00 00— CONCRETE</p> <p>Section: 03 20 00— Concrete Reinforcing</p> <p>Section: 03 21 00— Reinforcement Bars</p>	<p>REPORT HOLDER:</p> <p>BASALT ENGINEERING LLC</p>	<p>EVALUATION SUBJECT:</p> <p>BASTECH® BFRP REBAR</p>	
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1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2021 and 2018 [International Building Code® \(IBC\)](#)
- 2021 and 2018 [International Residential Code® \(IRC\)](#)

Properties evaluated:

- Physical
- Structural
- Durability

2.0 USES

The Bastech® basalt fiber-reinforced polymer (BFRP) bar is used as tension reinforcements in flexural concrete members such as beams, shallow foundations, and one-way or two-way elevated slabs, and as vertical reinforcement in concrete columns and walls in normal-weight concrete. The Bastech® BFRP bar may be used where an engineering design is submitted in accordance with Section R301.1.3 and were approved by the building official in accordance with Section R104.11.

3.0 DESCRIPTION

The Bastech® BFRP bar is basalt fiber-reinforced polymer (BFRP) bar that is solid and have circular cross section and composed of basalt fiber embedded in a resin matrix. Available bar size and properties are provided in [Table 1](#) of this report.

4.0 DESIGN AND INSTALLATION

4.1 Design:

The Bastech® BFRP bar must be designed in accordance with Basalt Engineering Design Manual, Document Number DM-1 (Version 2), document date December 14, 2022, Chapter 19 of the IBC (ACI 318-19 for 2021 IBC and ACI 318-14 for the 2018 IBC), and ACI CODE 440.11-22, as applicable. The registered design professional must be responsible for determining, through analysis, the strengths and demands of the structural elements, subject to the approval of the building official.

The following limitations also apply:

1. The Bastech® BFRP bar is limited for use as (a) tension reinforcement in flexural concrete members; (b) vertical reinforcement in concrete columns and walls.
2. The Bastech® BFRP bar is limited to concrete members in normal-weight concrete.

3. The bond coefficient, K_b of the Bastech® BFRP bar must be 1.2.
4. Bent shapes, continuous closed stirrups and ties (hoops) are outside the scope of this report.
5. There is no restriction for the shape of flexural concrete member cross-section (e.g., rectangular, T-shape, L-shape).
6. For multiple bar layers and bar bundling, the relevant provisions for steel reinforcing bar in ACI CODE 440.11-22 and ACI 318 must also apply to FRP bars, because the FRP bars have no plastic region and the stress in each reinforcing layer varies depending on its distance from the neutral axis. Thus, the analysis of the flexural capacity must be based on a strain-compatibility approach.

4.2 Installation:

The Bastech® BFRP bar must be located in the structure as set forth in the approved drawings and specifications. Reinforcement details, including tolerances, reinforcement relation, concrete cover and reinforcement supports, must comply with the applicable provisions in Part 3 of ACI SPEC 440.5-22 and installation instructions in Basalt Engineering Design Manual, Document Number DM-1 (Version 2), document date December 14, 2022.

4.3 Special Inspection:

Special inspection is required in accordance with Table 1705.3 of 2021 and 2018 IBC. The special inspector must verify, but are not limited to, the following:

1. The Bastech® BFRP bar is of the type and size specified and is labeled in conformance with this report.
2. The Bastech® BFRP bar is placed within tolerances set forth in ACI SPEC 440.5-22 Section 3.2 and are adequately supported and secured to prevent displacement during concrete placement.
3. The minimum concrete cover is provided in accordance with ACI SPEC 440.5-22 Section 3.2.
4. The placement of the Bastech® BFRP bar complies with the required spacing, profile and quantity requirements, as specified in the approved drawings and specifications.

5.0 CONDITIONS OF USE:

The Bastech® BFRP reinforcing bars described in this report complies with, or is a suitable alternative to what is specified in, those codes listed in Section 1.0 of this report, subject to the following conditions:

- 5.1 Design and installation must be in accordance with this report, ACI Code 440.11-22, the Basalt Engineering Design Manual, Document Number DM-1 (Version 2), document date December 14, 2022, and the IBC and IRC. In case of conflict, this report governs.
- 5.2 When requested, copies of the Design and Installation Instructions must be submitted to the code official for each project using the product.
- 5.3 Complete construction documents, including plans and calculations verifying compliance with this report, must be submitted to the code official for each project at the time of permit application. The construction documents must be prepared and sealed by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed.
- 5.4 The fire-resistance rating of the Bastech® BFRP bar reinforced concrete assembly is outside the scope of the evaluation report, and concrete assemblies with Bastech® BFRP bar are limited to Type VB construction under the IBC or IRC.
- 5.5 Bastech® BFRP bar must be stored above the surface of the ground on platforms, skids or other supports as close as possible to the point of placement. If stored outdoors, the Bastech® BFRP bar must be covered with opaque plastic or other types of cover that will protect the bars from ultraviolet rays.
- 5.6 Application of BFRP bars to be used in structural members for structures that are assigned in Seismic Design Categories C through F is permitted when following conditions are met: (1) structural members are not considered part of the lateral-force-resisting system, (2) structural members are not required to be designed to accommodate drifts and forces that occur as the building responds to a seismic event.
- 5.7 Special inspection must be provided in accordance with Section 4.3 of this report.
- 5.8 Bastech® BFRP bar is manufactured under a quality control program with inspections by ICC-ES.

6.0 EVIDENCE SUBMITTED

Data in accordance with the [ICC-ES Acceptance Criteria for Fiber-reinforced Polymer \(FRP\) Bars for Internal Reinforcement of Concrete Members \(AC454\)](#), dated October 2022, including fiber mass content, moisture absorption and alkaline resistance, and quality control documentation.

7.0 IDENTIFICATION

- 7.1 The Bastech® BFRP is identified by packaging labeled with the company name (Basalt Engineering LLC) and contact information, product name, bar size, lot number and evaluation report number (ESR-4648).
- 7.2 The report holder’s contact information is the following:

BASALT ENGINEERING LLC
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TABLE 1 – DIMENSIONS AND PROPERTIES

BAR DESIGNATION NUMBER	NOMINAL DIAMETER (in)	NOMINAL CROSS SECTIONAL AREA (in ²)	MEAN MEASURED CROSS SECTIONAL AREA (in ²)*	GUARANTEED ULTIMATE TENSILE FORCE (kip)	MEAN TENSILE MODULUS OF ELASTICITY (ksi)	MEAN ULTIMATE TENSILE STRAIN (%)	GUARANTEED TRANSVERSE SHEAR STRENGTH (ksi)	GUARANTEED BOND STRENGTH (psi)
3 (M10)	0.375	0.11	0.129	15.0	8200	2.1	33	1100
5 (M16)	0.625	0.31	0.353	33.6	7500	1.8	29	1100

For SI: 1 inch = 25.4 mm, 1 kip = 4.45kN, 1 psi = 6.89 kPa, 1 ksi = 6.89 MPa

*Mean measured cross sectional area includes surface ribs.