

ROCK REINFORCEMENT

GFRP Combination Bolts Glass Fiber Reinforced Polymer (GFRP) Bolting System



Normet's Glass Fiber Reinforced Polymer (GFRP) rock reinforcement systems offer superior alternatives to steel in applications where steel is unsuitable. Made from high-tensile fibers embedded in a polyester or epoxy resin matrix, GFRP offers greater tensile strength than steel while being four times lighter, ensuring easier handling and logistics. It is highly durable, corrosion-resistant, non-magnetic, chemically inert, and easily cuttable, making it suitable for both temporary and permanent applications.

Normet's GFRP Combination bolt is an innovative solution consisting of a GFRP fully-threaded bar with corrugated HDPE pipe and an expansion shell, designed for temporary or permanent applications in underground excavations.

WORKING PRINCIPLE

Normet's GFRP Combination Bolt System is composed of a GFRP fully threaded bar encased in a hollow, corrugated HDPE pipe, with an expansion shell at the distal end. The expansion shell enables tensioning upon installation, providing immediate support, while the corrugated HDPE pipe allows for post-grouting by directing grout into the HDPE sleeve, reaching the distal end of the borehole, and exiting through the overflow grout hole.

This system can be installed using conventional bolt installation methods and can be applied as immediate support systems and permanent reinforcement on metro/roadway/subsea tunnels and oil/gas storage caverns with corrosive environments and as temporary reinforcement in underground applications.

BENEFITS

- > **Stronger than Steel:** GFRP reinforcement offers exceptionally high tensile strength compared to its steel counterparts. This higher specification can result in cost-saving design opportunities and optimizations.
- > **Lightweight:** GFRP reinforcements are four times lighter than steel, resulting in ease of handling, faster installation, and cost savings on labour and transportation.
- > **Corrosion Resistant:** GFRPs are non-steel, durable materials that prevent premature bolt failure. Its exceptional corrosion and chemical resistance result in long durability and a long lifespan, making it an ideal and cost-effective alternative to coated steel.

- > **Cuttability:** GFRPs are easily cuttable and crushable, reducing concerns about steel being hauled and transported on conveyors into crushers, where steel elements can cause significant damage. It also eliminates resources and efforts associated with removing support elements from excavated ground.
- > **Sustainability:** GFRPs offer direct reductions in embodied carbon, and their higher strengths provide opportunities for further material reduction through design optimization.

RANGE AND SPECIFICATIONS

Parameter		GFRP - CB
Material Specifications	Outer Diameter (mm)	25
	Length (mm)	4,000
	Thread Direction	Left
	Bar (GFRP)	ECR + Epoxy Resin
	Coupler (Steel)	M36 x 120
	System Weight at 4.0 m (kg)	6.8
Fully Threaded Bar Mechanical Properties	Ultimate Tensile Load (kN)	350
	Ultimate Tensile Strength (MPa)	1,000
	Modulus of Elasticity (GPa)	555
Recommended Borehole Diameter (mm)		Ø43 - Ø45

