



SHREE

GLASS FIBER



KRUTIK VADALIYA

FUTURE OF RAINFORCEMENT



INTRODUCTION OF GFRP REBARS

WHAT ARE GFRP REBARS?

GFRP stands for **Glass Fiber Reinforced Polymer**. It is a composite rebar, which is a modern building material substituting the traditional metal Rebars.

GFRP Rebars consists of fibers of glass set in a resin matrix to form a rebar rod.

It is intended for reinforcing concrete structures which provide much more durability with its excellent properties in which the rod has a spiral wound belt extending above the core.

The first known usage of GFRP Rebars as a reinforcement was in the **former Soviet Union** in the **year of 1975**.

GFRP Rebars major usage began in **Europe** in the **1980s** which later gained significant support during the **1990s** from **maglev- magnetically levitated train** support structures in **Japan**. Thus, the Japanese were the first to introduce design guidelines for GFRP in reinforced concrete in the year 1996.

GFRP Rebars are 100% proven worldwide and are a corrosion prevention product which has a widespread usage in countries such as USA, Canada, Japan, Europe and Australia for more than **50 years**.

Having various unique and proven characteristics, GFRP Rebars are widely accepted in the construction industry worldwide and are one of the most technologically and economical in application reinforcement.

Mission

At **SGF**, our mission is to be instrumental in revolutionizing the construction industry by providing high-quality, durable, and sustainable GFRP Rebars. We are committed to advancing construction technologies and promoting environmentally friendly practices while ensuring the safety and longevity of structures. Our mission is to lead the way and put India on the global map through the production of GFRP Rebars.



Vision

At **SGF**, being pioneers of GFRP Rebars In India aspires to be the catalyst for change in the construction industry, through our **cutting-edge research** and **technological excellence**. To be the go-to solution for your construction projects and to lead the rebar revolution by being the premier manufacturer of GFRP Rebars, setting new standards for durability, innovation, and environmental responsibility.



Core Values



Continuous Betterment

There is always room for improvement. To have a learning attitude always.



Integrity

Upholding honesty, transparency, and ethical behaviour in all business dealings. Building trust with customers, suppliers, and employees through consistent integrity.



Cost Efficiency

Striving for operational efficiency and cost-effectiveness is a common core value helping companies maintain competitiveness in the market.



Reliability

Consistently delivering products on time and as promised. Building a reputation for reliability and dependability in the market.



Quality

Commitment to producing high-quality products that meet or exceed customer expectations.



Ethics

To work in an ethical manner always. To provide quality products always.



Sleeve Up Approach

To have a trick, solution, method etc. and use it when needed.



WHY CHOOSE GFRP REBARS

When applied correctly, **SGF GFRP Rebars** have a great deal of advantages in reinforced concrete structures particularly a dramatic reduction in problems related to corrosion, either by intrinsic concrete alkalinity or by external corrosive fluids that might penetrate the concrete in the future. These structures can be significantly lighter and have a much longer service life of up to 100 years and more.

SGF GFRP Rebars are useful for structures where the presence of metal reinforcement would not be acceptable. For example, magnetic resonance imaging (MRI) machines have large magnets, and accordingly require non-magnetic buildings. **SGF GFRP Rebars** would be a perfect fit for such applications.

Also, where the design life of the concrete structure is important, **SGF GFRP Rebars** reinforcing has its advantages, where corrosion of reinforcing metal bars is a major cause of failure. In such situations corrosion-proof **SGF GFRP Rebars** will extend a structure's life substantially, for example in marine structures or any water bodies.

SGF GFRP Rebars will also be useful in situations where it is likely that the concrete structure may be compromised in future years, for example the edges of balconies when balustrades are replaced and bathroom floors in multi-story construction where the service life of the floor structure is likely to be many times the service life of the waterproofing building membrane.

The material properties of GFRP Rebars differ from metal rebars, so there are differences in the design considerations. GFRP Rebars have relatively higher tensile strength but lower stiffness, so that deflections are likely to be higher than for equivalent metal reinforced units.

Structures with internal GFRP reinforcement typically have an elastic deformability comparable to the plastic deformability (ductility) of metal reinforced structures. Failure in either case will occur by compression of the concrete rather than by rupture of the reinforcement. Deflection is always a major design consideration for reinforced concrete. Therefore, deflection limits are set to ensure that crack widths in metal reinforced concrete is controlled to prevent water, air or other aggressive substances reaching the metal rebars and causing corrosion.

As there is no danger of corrosion, for GFRP reinforced concrete, aesthetics and possibly watertightness will be the limiting criteria for crack width control. GFRP Rebars also have relatively lower compressive strengths than metal rebars, and accordingly require different design approaches for reinforced concrete columns.

Since the extensive use of GFRP as structural reinforcement has increased exponentially and design guidance has been authored by organizations from around the world and in India, till now the high initial purchase cost has restricted its usage and application. **SGF** GFRP Rebars are however being offered at prices below metal reinforcement market price.

A potential limit to the use of GFRP **SGF** reinforcement is the limited fire resistance. Where fire safety is a consideration, structures employing GFRP must maintain their strength and the anchoring of the forces at temperatures to be expected in the event of fire. For purposes of fireproofing an adequate thickness of cement concrete cover or protective cladding is necessary.

Therefore, it is not always possible to replace the reinforcement metal rebars by GFRP Rebars, because of the above said limitations and the fact that mechanical properties of the two materials differ. For example, E-modulus and shear strength of GFRP Rebars are lower, but the tensile strength is significantly higher than that of

metal rebars. Nevertheless, the applicability's of the **SGF** GFRP Rebars reinforcement are greater than their planning restrictions compared to metal reinforcement.

As such there is growing interest in application of **SGF** GFRP Rebars which are recognized by different countries and number of projects using composite rebar increases day by day around the world, ranging from USA, Russia, Japan, South Korea and Germany.

ATTRIBUTES OF SGF GFRP REBARS



**Corrosion
Resistant**



Stronger



Lighter



**Cost
Effective**



**Zero
Maintenance**



**Longer Life
Span**



Eco Friendly



Dielectric



**Easy to
transport**



Water resistant



**Less thermal
expansion**



**Radio
Transparent**



Durable



**Lower
installation cost**



**Easy site handling
& easy cutting**



**Faster and safer
installation**



**Reduced concrete
coverage**



**Savings in
overlapping cost**

ATTRIBUTES OF SGF GFRP REBARS

Corrosion Free Application

- Marine precast walls
- Pipe sleepers / railways sleepers
- Bridge decks & approach slabs
- Roads and infrastructure
- MSE walls
- Warehouse / industrial floorings
- Building foundations, basements, retaining walls, compound walls
- Coastal regions, parking lots, swimming pools
- Underwater structures
- RCC Roads

Nonconductive / Nonmagnetic applications:

- Hospitals
- Airport compass calibration pads
- Power plants and transformer sites
- Light rails

High chemical resistance & industrial applications

- Industrial applications
- Sewage treatment plants
- Agricultural facilities
- Industrial facilities
- Chemical plants
- ETP plants
- Culverts
- Storm water drain channels

Other Applications

- Energy efficient buildings
- Cold storage warehouses

APPLICATIONS OF SGF GFRP REBARS



RCC roads



Pavements



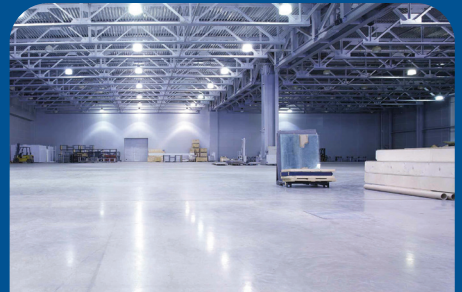
Drainage



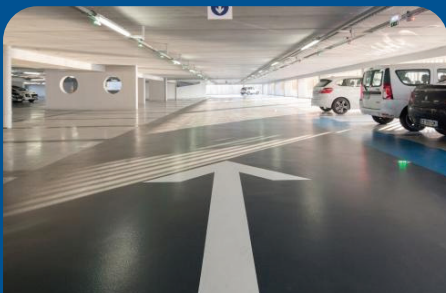
Crash barriers



Friction Slab



Industrial Floorings



Parking's



Concrete slabs



Chemical plants



Precast



Foundations



Walls

APPLICATIONS OF SGF GFRP REBARS



Columns



**Water & waste water
treatment plants**



**Dams, sea walls &
marine applications**



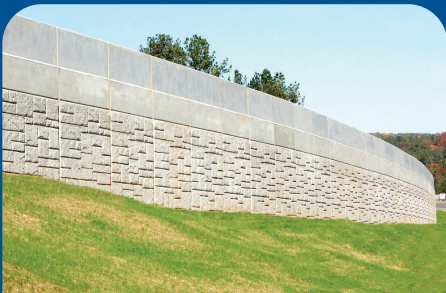
**RCC floorings built
in or close to the sea**



**Highway
construction**



Bridge decks



Barrier walls



**Underground water
tanks**



Swimming pools



Approach slab



Hospital MRI areas



**Tunneling & temporary
reinforcement**



Site Photographs of SGF GFRP Rebars

Shree Glass Fiber India began production & domestic sales of GFRP Rebars in India since the year 2023 and has been India's largest manufacturers and Suppliers of GFRP Rebars as well as becoming India's no. 1 selling GFRP Rebars brand.

Since 2023, SGF GFRP Rebars have been a hit in the Indian market and Team SGF has been successful in completing more than 2000+ Projects across India.

Below are some real photographs of usage of SGF GFRP Rebars in India:

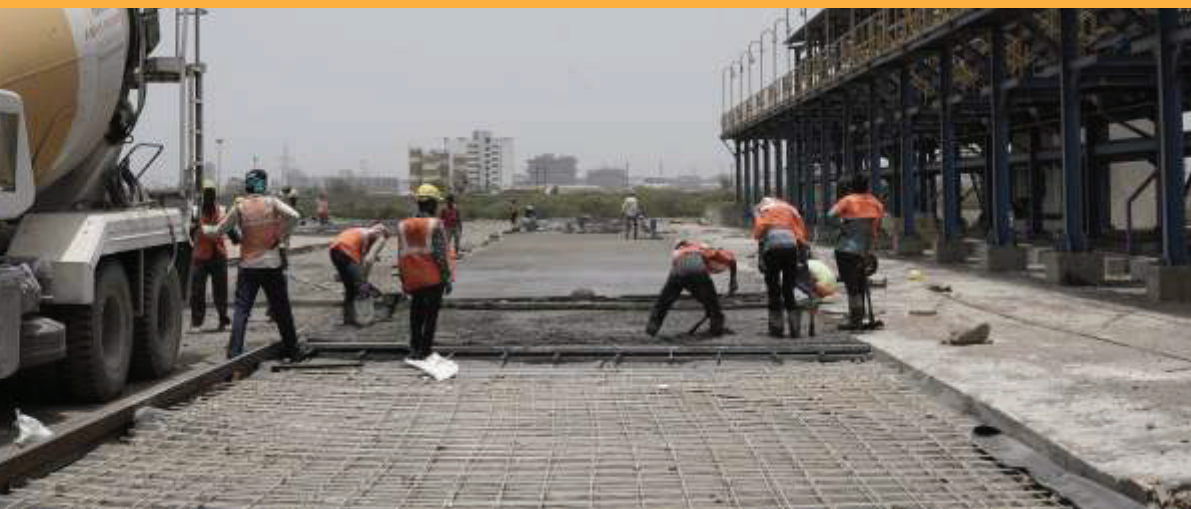




TABLE OF SUBSTITUTION BY TENSILE STRENGTH

SGF GFRP REBARS			METAL REBARS	
Diameter	Weight (Per 12 meter bar)		Diameter	Weight (Per 12 meter bar)
3.0 mm	0.185 Kg	=	----	----
3.5 mm	0.280 Kg	=	----	----
4.5 mm	0.468 kg	=	06 mm	2.75 kg
6.0 mm	0.570 kg	=	08 mm	4.74 kg
7.0 mm	0.900 kg	=	10 mm	7.40 kg
8.0 mm	1.200 kg	=	12 mm	10.65 kg
10.0 mm	1.600 kg	=	14 mm	14.52 kg
12.0 mm	2.400 kg	=	16 mm	18.93 kg
14.0 mm	3.240 kg	=	18 mm	24.00 kg
16.0 mm	4.870 kg	=	22 mm	35.76 kg
18.0 mm	6.280 kg	=	25 mm	46.22 kg
20.0 mm	8.080 kg	=	28 mm	58.02 kg
22.0 mm	9.800 kg	=	32 mm	75.79 kg
25.0 mm	11.670 kg	=	40 mm	118.52 kg

Notes ● These are approximate values ● (=) Equal ultimate stress

MECHANICAL PROPERTIES OF SGF GFRP REBARS WHEN COMPARED TO METAL REBARS

MATERIAL	METAL REBARS	SGF GFRP REBARS
Tensile strength (Mpa or N/mm ²)	500 - 600	1000+
Shear strength	120	≥ 150
Bond strength (Mpa or N/mm ²)	14*	≥ 11
Compression (Mpa or N/mm ²)	500	450
Modulus of elasticity (Gpa)	160 – 200	≥ 50
Elongation (%)	25	≥ 1.5
Durability	Terms are prescribed in special building codes	80 years +
Density (Ton/m ³)	7.8	1.9
Corrosion resistance to aggressive environment	Appearance of rust	Stainless material preserving properties even in alkaline concrete environment
Ecological compatibility	Ecologically friendly material	Does not emit harmful and toxic substances during storage and use
Electrical conductivity	Electrically conductive material	dielectric

The background of the entire page is a deep blue color with a faint, light blue world map. The map shows the continents of North America, South America, Europe, and Africa. In the foreground, there is a large, curved concrete structure, likely a dam or a large water storage tank. The structure has a curved walkway with a metal railing. Two small figures of people are visible on the walkway, providing a sense of scale. The top of the image features a horizontal strip of a textured, brownish-gold material, possibly a piece of wood or a decorative element. The title text is centered in the upper half of the image, overlaid on a white rectangular background.

**STANDARDS &
DESIGN GUIDES OF
GFRP REBARS**
IN INDIA & ACROSS
THE GLOBE

1. INDIA

IS 18255 : 2023

Fibre-Reinforced Polymer (FRP) Rebars for Concrete Reinforcement – Methods of Test.

IS 18256 : 2023

Solid round glass fibre reinforced polymer (GFRP) Rebars for Concrete Reinforcement – Specification.

IRC : 137 - 2022

Guidelines on use of fibre-reinforced polymer bars in road projects.

2. USA

ACI 440. 1R-06 (2006)

"Guide for the design and construction of structural concrete reinforced with FRP Rebars", American Concrete Institute

ACI 440. 3R-04 (2004)

"Guide for test methods for Fiber Reinforced Polymers (FRP) for Reinforcing or Strengthening Concrete Structures.

ACI 440R-07 (2007)

"Report on Fiber-Reinforced Polymer (FRP) Reinforcement for Concrete Structures," ACI Committee 440.

ACI 440.1-15 (2015)

"Guide for the Design and Construction of Structural Concrete Reinforced with Fiber-Reinforced Polymer Bars," ACI Committee 440.

ACI 440.3R-12 (2012)

"Guide Test Methods for Fiber-Reinforced Polymers (FRPs) for Reinforcing or Strengthening Concrete Structures," ACI Committee 440.

ACI 440.6M-08 (2017)

"Specification for Carbon and Glass Fiber-Reinforced Polymer Bar Materials for Concrete Reinforcement", ACI Committee 440

ACI 440.5-18 (2018)

"Specification for Construction with Fiber-Reinforced Polymer Reinforcing Bars," ACI Committee 440.

AASHTO GFRP-1 (2009)

AASHTO LRFD Bridge Design Guide Specifications for GFRP – Reinforced concrete Bridge Decks and Traffic Railings", American Association of State Highway and Transportation Officials.

FHWA-HRT-05-081 (2005)

"Design of Continuously Reinforced Concrete Pavements using Glass Fiber Reinforced Polymer Rebars." Federal Highway Administration, US Department of Transportation.

FDOT (2021),

"Florida Department of Transportation Standard Specifications for Road and Bridge Construction." Florida Department of Transportation.

AASHTO (2018),

"LRFD Bridge Design Guide Specifications for GFRP Reinforced Concrete," American Association of State Highway and Transportation Officials.

3. CANADA

CAN/CSA-S807-10

"Specifications for Fiber Reinforced Polymers"

CAN/CSA-S806-12

"Design and Construction of Building Components with Fiber-Reinforced Polymers"

CAN/CSA-S6-06 (2006)

Fiber-Reinforced Structures, "Canadian Highway Bridge Design Code", pp.693-728.

CSA CAN/CSA-S6-06 (2006)

"Canadian Highway Bridge Design Code." Standards Council of Canada.

4. JAPAN

JSCE Series 23

"Recommendation for Design and construction of Concrete structures using continuous Fiber Reinforced Material".

JBDPA Design Manual (2009)

"Japanese Design and Construction Guidelines for Seismic Retrofit of Building Structure with FRP composites."

5. GERMANY

DIN1045-1

"EN-Concrete Reinforced and Pre-stressed Concrete Structures – part 1: Design and Construction."

6. SWITZERLAND

Fib Bulletin No.40 (2007)

"FRP Reinforcement in RC Structures"

7. AUSTRALIA

Transport for NSW (2020)

"Technical Guide Design of Continuously Reinforced Concrete Pavement using Glass Fibre Reinforced Polymer (GFRP) Bars at Traffic Loop Locations," Document Number P-G-008, New South Wales Government, Australia.

8. EUROPE

EN-13706 (EUROPE)

9. ITALY

CNR-DT 203 & CNR-DT 205 (ITALY)

10. RUSSIA

GOST 9.071-76 (RUSSIA)

11. OTHERS

ASTM D570-98 (2018)

"Standard Test Method for Water Absorption of Plastics," ASTM International.

ASTM D578/D578M-18 (2018)

"Standard Specification for Glass Fiber Strands," ASTM International.

ASTM D792-20 (2020)

"Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement," ASTM International.

ASTM D2584-18 (2018)

"Standard Test Method for Ignition Loss of Cured Reinforced Resins," ASTM International.

ASTM D3171-15 (2015)

"Standard Test Methods for Constituent Content of Composite Materials," ASTM International.

ASTM D7205/D7205M-21 (2021)

"Standard Test Methods for Tensile Properties of Fiber-Reinforced Polymer Matrix Composite Bars," ASTM International.

ASTM D7617/D7617M-11 (2017)

"Standard Test Method for Transverse Shear Strength of Fiber-reinforced Polymer Matrix Composite Bars," ASTM International.

ASTM D7705/D7705M-12 (2019)

"Standard Test Method for Alkali Resistance of Fiber Reinforced Polymer (FRP) Matrix Composite Bars used in Concrete Construction," ASTM International.

ASTM D7913/D7913M-14 (2020)

"Standard Test Method for Bond Strength of Fiber-Reinforced Polymer Matrix Composite Bars to Concrete by Pullout Testing" ASTM International.

ASTM D7957/D7957M-17 (2017)

"Standard Specification for Solid Round Glass Fiber Reinforced Polymer Bars for Concrete Reinforcement" ASTM International.

ASTM E1356-08 (2014)

"Standard Test Method for Assignment of the Glass Transition Temperatures by Differential Scanning Calorimetry." ASTM International.

ASTM E2160-04 (2018)

"Standard Test Method for Heat of Reaction of Thermally Reactive Materials by Differential Scanning Calorimetry." ASTM International.

THE INDORE FACILITY - INDIA'S MOST ADVANCED GFRP MANUFACTURING PLANT

INDIA'S FIRST CT6 PULTRUSION LINES

- High-Speed, Fully Automated Production Ensuring Consistent Quality
- Real-Time Quality Monitoring At Every Production Stage
- Precision Control Of Fiber-Resin Ratios For Optimal Strength
- Capability To Produce Diameters From 3mm to 20mm

INDIA'S FIRST CNC-CONTROLLED BENDING LINES

- The First And Only CNC Bending Facility In India For GFRP Rebar
- Precision-Engineered Bent Elements Matching Exact Structural Drawings
- Custom shapes: Stirrups, Hooks, Links, U-bends, And Complex Geometries
- Perfect angles Every Time - Eliminates Human Error
- Factory Precision Impossible With Manual Bending
- Complete Traceability For Bent Elements

This Combination Of European Technology And Indian Manufacturing Creates A Facility Unmatched In Quality, Precision, And Reliability.

IN-HOUSE TESTING FACILITIES

Testing Capabilities:

- Tensile Testing: Ensures Strength Meets Or Exceeds BIS 18256 and ASTM F3216 Specifications.
- Fiber Content Analysis: Validates Composite Quality And Consistency
- Dimensional Verification: Precision Checks On Diameter And length
- Resin Content Testing: Confirms Optimal Fiber-Resin Ratios
- Surface Quality Inspection: Checks For defects and Uniformity
- Batch Traceability: 100% Material Tracking For Compliance Documentation

Quality Assurance Process:

- Every production batch undergoes rigorous testing
- Documentation of all test results for client records
- Third-party verification capabilities for government projects
Partners - NABL-accredited facilities
- Real-time quality monitoring throughout production

Benefit for You: Complete confidence in product quality with full documentation. No need for external testing labs-quality assurance is built into our manufacturing process.

PRODUCTION CAPACITY & SCALABILITY

Current Production Capacity :

CURRENT OPERATIONAL OUTPUT (Fully Operational):

- Straight Rebar Production: 100 tons per month
- Bent Elements Production: 6 tons per month (CNC precision bending)
- Total Current Capacity: 106 tons/month combined

DESIGN CAPACITY (Engineered for Expansion):

- Maximum Facility Capacity: 500 tons per month
- Modular Expansion: Add production lines without facility disruption
- Expansion Strategy: Phased approach maintains quality during growth

This strategic capacity planning ensures:

- Reliable supply for current projects
- Ability to support mega-infrastructure projects
- Quick response to market demand spikes
- Partnership opportunities with major contractors
- Consistent quality maintained during scale-up
- 100 tons per month of GFRP rebar production
- Multiple diameter options: 6mm, 8mm, 10mm, 12mm, 16mm, 20mm
- Standard lengths: Custom cut to project specifications
- Bent element production: Integrated within manufacturing cycle

Future Expansion Capability:

- Scalable to 500 tons per month capacity
- Phased expansion without compromising quality
- Additional machinery lines planned for regional distribution
- Projected timeline: 24-36 months to full capacity

What This Means for You:

- Reliable supply for medium to large projects
- No production bottlenecks or delivery delays
- Consistent quality maintained during scale-up
- Strategic partnership opportunity for major contractors
- Flexible order quantities from 5 tons to 100+ tons per month

Production Timeline:

- Standard orders: 2-3 weeks from order confirmation
- Custom bent elements: 3-4 weeks
- Rush orders: Available with premium scheduling
- Project-specific batching: Full traceability maintained

Why Us Stands Out:

IIT KHARAGPUR ENGINEERING EXPERTISE

Leadership team with deep technical knowledge in composite materials and structural engineering

EUROPEAN TECHNOLOGY PARTNERSHIP

State-of-the-art pultrusion machinery from Composite Tech ensures international quality standards

IN-HOUSE BENT LINE FACILITY

Custom reinforcement shapes without delays or multiple supplier management

IN-HOUSE TESTING LABORATORIES

Complete quality assurance with tensile testing, fiber content analysis, and batch traceability

SCALABLE PRODUCTION CAPACITY

Current: 100 tons/month | Expandable to: 500 tons/month
Ensures reliable supply for projects of any size

LOCAL MANUFACTURING IN INDIA

Fast delivery, responsive customer support, custom solutions tailored to Indian infrastructure needs

GOVERNMENT COMPLIANCE

BIS 18256 certified, meeting PWD, Railway, and Smart Cities project requirements

COMPLETE CLIENT SUPPORT

From technical consultation through project completion and beyond

TECHNICAL DETAILS

OF GFRP REBARS



Tensile Strength

SGF GFRP Rebars is known for its superior tensile strength. It is at least two times stronger than conventional steel of the same diameter. This high tensile strength allows the rebar to withstand pulling or streaming forces, increasing the strength of structures, enabling them to handle heavy loads. This strength advantage, along with its corrosion resistance, lightweight properties, and design versatility, makes **SGF** GFRP Rebar a compelling choice in the construction industry.



Modulus of Elasticity

The modulus of elasticity, also known as Young's modulus, is a measure of the stiffness of a material. For **SGF** GFRP (Glass Fiber Reinforced Polymer) Rebar, the modulus of elasticity is significantly lower than that of steel.

Specifically, the modulus of elasticity of GFRP rebar is around 55 GPA, compared to 160 GPA steel. This lower modulus of elasticity is often misunderstood as a disadvantage, but in fact, it can be beneficial in certain applications.

For instance, in slabs on grade such as floors, parking lots, roads, and highways, the lower modulus of elasticity of GFRP rebar can be a positive attribute. It allows the concrete structure to flex more under load, which can help distribute stresses more evenly and reduce the risk of cracking. So, while GFRP rebar may have a lower modulus of elasticity than steel, this property can actually enhance its performance in certain applications.



Shear Strength

SGF GFRP (Glass Fiber Reinforced Polymer) Rebar's shear strength is significantly influenced by the orientation of its reinforcing fibers within the polymer matrix.

 Durability

SGF GFRP Rebar has impressive durability and longevity, even in harsh environmental conditions. Here are some key points about its durability :

Corrosion Resistance: GFRP Rebar is immune to corrosion, even in harsh environments with moisture, chemicals, or saltwater. This inherent corrosion resistance ensures that the structural integrity of the construction remains intact over time, reducing the risk of deterioration and the need for costly repairs or maintenance.

Additionally, the reduced weight minimizes the overall dead load on the structure, making it particularly beneficial for projects with weight restrictions or seismic considerations.

 Alkaline Resistance

SGF GFRP Rebar has superior resistance to a wide range of chemicals, including alkalis. This makes it highly resistant to corrosive environments, ensuring its long-term durability.

GFRP Rebar is composed of high-strength glass fibers embedded in a polymer resin matrix. It's ideal for applications in harsh environments, such as marine structures and roadways exposed to de-icing salts.

This inherent resistance to chemical and environmental degradation ensures the long-term structural integrity of base slabs, minimizing the need for costly repairs and maintenance interventions throughout the lifespan of infrastructure projects. This makes GFRP Rebar a promising alternative for enhancing the performance and sustainability of base slab construction.

TECHNICAL DETAILS

OF GFRP REBARS



Creep Rupture is a phenomenon where a material fails due to exposure to high stress over a long period of time. In the context of Glass Fiber Reinforced Polymer (GFRP) rebars, this refers to the failure of the rebar when subjected to high stress for an extended period.

GFRP Rebar has been studied for its creep rupture characteristics. key points about Creep Rupture:

Creep Coefficient : The creep coefficient of an RC beam reinforced by GFRP rebar with a minimum guaranteed tensile strength of 900 MPa has been studied. The material creep test result showed that a service life of 100 years can be guaranteed when the sustained load magnitude is less than 50% of the maximum tensile load capacity of the rebar.

Long-term Performance: Long-term creep tests were performed under two levels of sustained tensile stress equivalent to 20% and 40% of the UTS of the bar up to 1670 hours

Please note that these are research findings and actual performance can vary based on various factors such as manufacturing process, environmental conditions, and specific application. Always consult with a structural engineer or a professional in the field for specific applications..



GFRP bars have relatively higher tensile strength but lower stiffness, so that deflections are likely to be higher than for equivalent steel reinforced units.



Bond Behavior

The bond behavior of **SGF** GFRP Rebar is a critical aspect of its performance in reinforced concrete structures. Some key points about its bond behaviour:

Bond Strength: Ribbed GFRP bars exhibit the highest bond energy of 89.4 Nmm and an average bond strength of 11.5 Mpa.

Concrete Strength and Cover Thickness: The effects of concrete strength and cover thickness appear to have a limited impact on the bond strengths of GFRP rebars.



Crack Width

The crack width of GFRP Rebar is a critical aspect of its performance in reinforced concrete structures.

Crack Width Calculation: The crack width calculation of a GFRP reinforced section is the same as that of a steel reinforced section. The only difference is there is a bond dependent factor (k_b) in the GFRP crack width calculation.



Thermal Conductivity

GFRP rebar has low thermal conductivity, which reduces the risk of thermal expansion and contraction, mitigating the potential for cracking and spalling in the base slab.

TECHNICAL DETAILS

OF GFRP REBARS



Thermal Expansion

Thermal expansion of GFRP Rebar refers to how the material expands or contracts due to changes in temperature.

This is lower than steel rebars thermal expansion coefficient (around $12 \mu\text{m}/\text{m}^\circ\text{C}$). GFRP rebars lower thermal expansion helps minimize concrete crackings and damages.



Elongation

In terms of elongation, GFRP rebar has been found to have less elongation than typical steel rebar. This means that while GFRP rebar can withstand high tensile forces, it does not stretch or deform as much as steel rebar under the same forces. This characteristic can be beneficial in certain applications where minimizing deformation is important.



Fire Resistance

SGF GFRP Rebar is considered to be fire resistant. It doesn't burn directly. Adopting relatively small concrete cover thicknesses can still attain considerable fire endurance provided that the anchors of the GFRP rebars remain sufficiently cold.

For more specific information about the fire resistance of **SGF** GFRP Rebar in your particular application, you may want to contact the manufacturer directly or consult with a structural engineer. They can provide guidance based on the specific requirements of your project.

MACHINING WHILE USING

SGF GFRP REBARS



Cutting of SGF GFRP Rebars

Cutting of **SGF** GFRP Rebars is very easy and like steel Rebars and can be done using same methods of cutting steel Rebars such as using a grinder, band saw, hacksaw or by a diamond cut or hard cutting disk. Any tool used as mentioned can achieve a clean cut of **SGF** GFRP Rebars. Glass fiber frays/threads may shear off if trimmed or if not cut with a proper cutting tool.



Bending of SGF GFRP Rebars

SGF GFRP Rebars are linearly elastic up to failure. They cannot be bent permanently or on site at the time of use. If you try to bend the bar, it will return to its original shape once the bending force applied is removed.

SGF GFRP BENT Rebars, and stirrups are also available in the market which are customized and prefabricated as per customers' requirements.



Binding of SGF GFRP Rebars

SGF GFRP Rebars can be tied with each other the same way as traditional steel Rebars. Any binding can be used while using GFRP Rebars. Traditional binding wires can be surely used as well as plastic clips or knitting wire with the help of plastic fix clips.

CERTIFICATIONS & STANDARDS COMPLIANCE

CURRENT CERTIFICATIONS:

- **BIS 18256:2016 - Indian Standard for GFRP Rebar**
Ensures compliance with Indian government project requirements
- **ISO 9001:2015 - Quality Management System**
Demonstrates commitment to consistent quality processes
- **ISO 17025 Compliant Testing Processes**
Laboratory testing meets international standards for accuracy and reliability
- **ASTM F3216 - American Standard for GFRP Rebar**
International recognition for material properties and performance

ADDITIONAL COMPLIANCE:

- **IRC:137-2022 - Indian Road Code compliance for highway applications**
- **Indian Railways technical specifications (in progress)**
- **Third-party lab verification available for government tenders**
- **100% material traceability for all production batches**

Why Certifications Matter:

- **Government Projects:** BIS certification is mandatory for PWD, Railways, Smart Cities
- **International Standards:** ASTM F3216 ensures global quality benchmarks
- **Quality Assurance:** ISO 9001 guarantees consistent manufacturing processes
- **Documentation:** Full traceability for compliance and auditing



QUALITY ASSURANCE & TESTING PROTOCOLS

Every production batch undergoes rigorous quality testing before delivery:

Pre-Production Quality Control:

- Raw material inspection (glass fiber and resin verification)
- Fiber-to-resin ratio optimization
- Equipment calibration and verification

During-Production Monitoring:

- Continuous process parameters tracking
- Real-time quality checks at production stages
- Dimensional accuracy verification

Post-Production Testing (Every Batch):

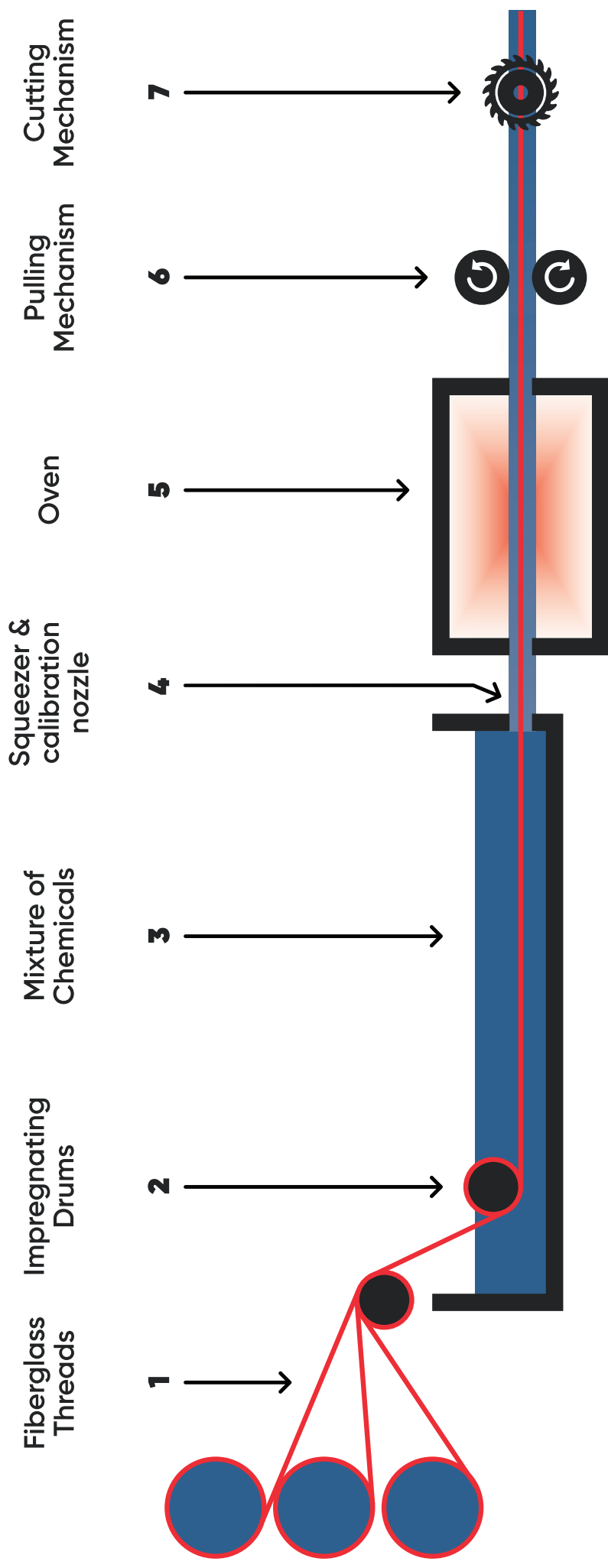
- Tensile strength testing
- Fiber content analysis
- Surface quality inspection
- Dimensional verification
- Batch-specific documentation

Client Confidence:

- Test certificates provided with every delivery
- Full traceability documentation
- Third-party verification available
- On-site inspection facility tours available
- Technical consultation for project-specific requirements

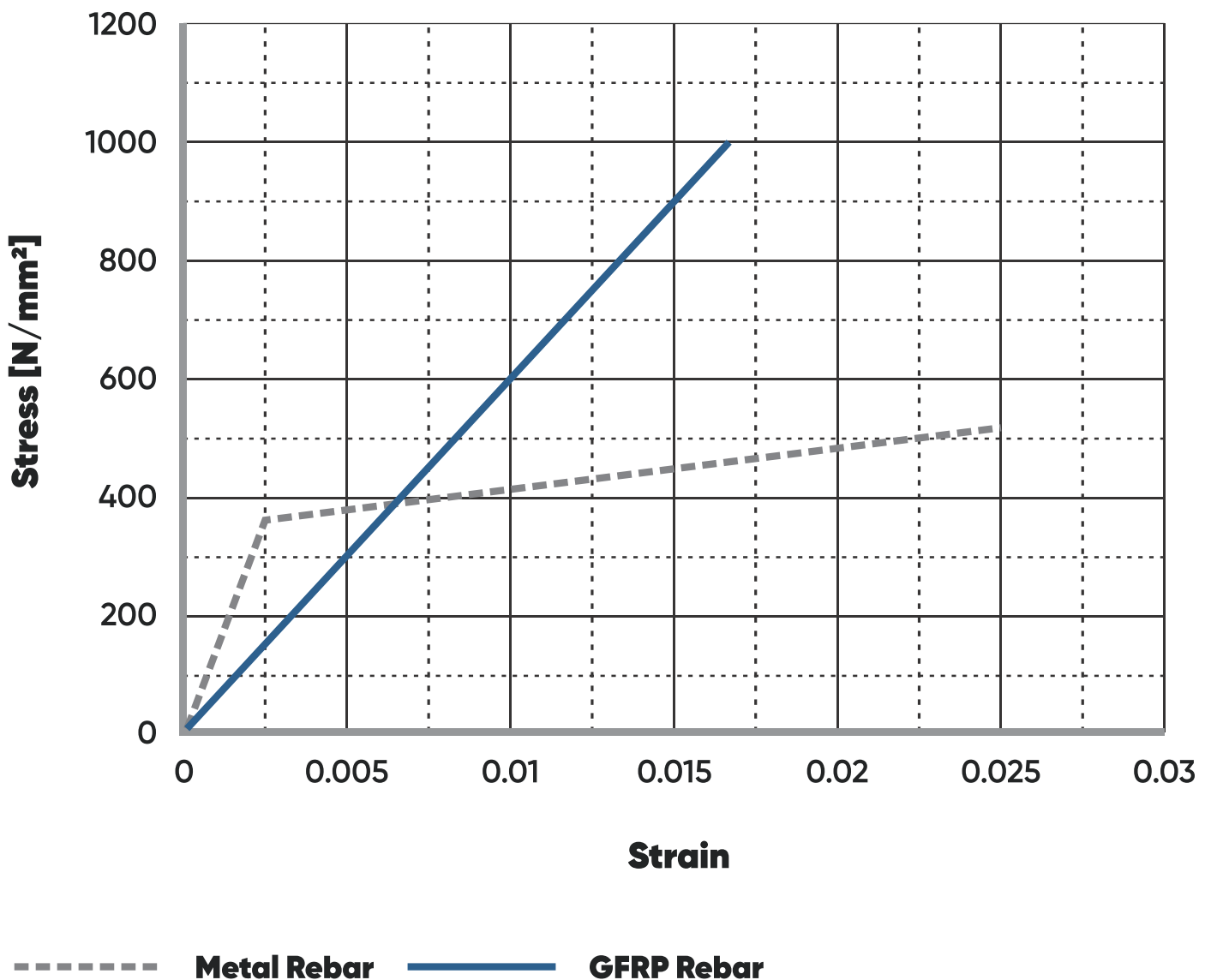


How are SGF GFRP Rebars made and what is the process?



The **SGF GFRP Rebars** manufacturing and production process is known as the pultrusion or extrusion process

THE STRESS-STRAIN CURVE



Unlike metal, GFRP Rebars do not have a distinct yield point, and rupture occurs suddenly without significant deformation. The ultimate tensile strength is between 800-1200 Mpa. The failure strain typically falls between 1.5-2.5%, while the modulus of elasticity ranges from 40-60 Gpa.

Factors influencing the stress-strain curve include fiber volume fraction, fiber orientation, matrix material properties, manufacturing process, and environmental conditions. Standards such as ASTM D7205/D7205M and ACI 440R provide guidelines for tensile testing and design.

FAQ's

FREQUENTLY ASKED
QUESTIONS



1. How are **SGF GFRP Rebars** better than metal rebars? What are the advantages of composite reinforcement in comparison with metal reinforcement?

Strength : composite reinforcement has strength characteristics which are 2-3 times superior to steel reinforcement.

Durability : the coefficient of temperature expansion of composite reinforcement is close to the coefficient of thermal expansion of concrete, so that in concrete structures there are no associated micro deformations, microcracks and the overall durability of the structure is substantially increased.

Corrosion resistance : As we know that steel rebars are prone to corrosion and have a life of 20-25 years whereas GFRP Rebars are 100% anti corrosive in nature and have a life of over 80 years making it much more durable. Chemical resistance - composite reinforcement has great chemical resistance in various aggressive environments, it is not susceptible to corrosion which also positively affects the durability.

Lightweight : composite reinforcement with comparable strength characteristics is lighter than steel reinforcement by almost 4 times.

Low thermal conductivity : due to low thermal conductivity, "temperature bridges" are not formed on the structures, which reduces the thermal loss to 34% and accordingly the conditioning cost of the building.

Easy installation : composite rebars can be cut from the bay of any given length which increases speed of work at site, later fastened with plastic clips, special fasteners/clamps or just with traditional binding wires.

Easy transportation and storage : you can fold the composite rebars into coils at the time of production, which allows us to use even cars, autos, scooters for transportation and save on transport cost significantly.

As we know that GFRP rebars have a density of only 1.9 Tons /m³ making it almost 4 times lighter than metal rebars. This helps in loading 4 time more material into trucks than steel and can save a significant amount on logistics costs.

Custom length : unlike metal reinforcement, composite Rebars can be provided in custom lengths which can help in reducing costs as no overlapping is required and time, labor cost is saved.

2. Is it possible to use **SGF GFRP Rebars** together with metal rebars?

Yes, you can use **SGF GFRP Rebars** together with metal rebars in some cases where it is necessary.

3. What are the disadvantages of composite reinforcement in comparison with traditional metal reinforcement?

Modulus of elasticity

the modulus of elasticity of composite reinforcement is almost 4 times lower than that of metal reinforcement, even with an equal diameter. In other words, it easily bends. For this reason, it can be mostly used in ground applications where usage in floors requires additional calculations.

Dielectric

composite reinforcement unlike metal reinforcement cannot be welded by electric welding.

Temperature

when heated to a temperature of 600 degrees Celsius, the compound that binds the composite reinforcement fibers softens so much that the reinforcement loses its elasticity.

To increase the stability of the structure in the event of fire, additional measures should be taken to heat protect the structures that use composite reinforcement.

Bending

composite reinforcement unlike metal reinforcement does not have mechanical properties which are elastic, thus it doesn't allow you bend material on site.

4. How does GFRP Rebars work during earthquakes?

Due to higher fatigue properties, GFRP Rebars have a higher resistance to cyclical loads of high intensity, which makes GFRP Rebars workable during earthquakes subject to a detailed design report on the same.

5. Which reinforcement has a better bond with concrete/cement? Composite reinforcement or metal reinforcement?

Both composite reinforcement and metal reinforcement have approximately the same adhesion to concrete/cement.

6. What kind of binding material is needed while using GFRP Rebars?

Any binding can be used while using GFRP Rebars. Traditional binding wires can be surely used as well as plastic clips or knitting wire with the help of plastic fix clips.

7. What is the behavior of GFRP Rebars in case of a fire?

Composite reinforcement is fire resistant up to 600 degrees Celsius. Once the temperature exceeds 600 degrees Celsius, the compound that binds the composite reinforcement fibers softens. Composite reinforcement does not burn directly, and studies show that structures are sustainable during a fire.

8. Can you bend/curve GFRP Rebars on site?

No, as the mechanical properties of GFRP Rebars are elastic, thus it does not allow you to bend the material on site. However, you can get your desired bend/curved elements prefabricated as per your requirement.

9. How does composite reinforcement strength depend on the ambient temperature?

The change in ambient temperatures on the strength of composite reinforcement is practically unaffected. GFRP Rebars can be used at temperatures from (-70 degrees Celsius) to (+120 degrees Celsius) without being affected.

10. What class and type of concrete/cement should be used while using composite reinforcement?

When reinforcing concrete/cement structures with GFRP Rebars, special requirements to the components of the concrete mixture (cement, aggregates additives) are not presented. It is also possible to use composite reinforcement with Portland cement and its varieties (sulfate resistant, hydrophobic etc.) The quality of concrete mixtures and the technology of their preparation should ensure the production of concrete structures that meet the requirements for standardized quality indicators.

11. Is it possible to use composite reinforcement in slabs and walls?

Yes, at the same time it is required to provide the necessary reinforcement area and the compliance with the requirements for fire resistance of a concrete structure. Depending on the loads and design features, additional calculations of the designers are needed. According to the general recommendations, GFRP Rebars can be used in load bearing structures of buildings up to 3 floors with detachable formwork and up to 5 floors with fixed formwork.

12. Is it possible to use composite reinforcement for pile reinforcement?

Yes, the corrosion resistance of composites piles is substantially higher than that of steel reinforced concrete piles.

13. Do GFRP Rebars have any Indian standards?

Indian standards of GFRP Rebars in India are **IS 18255 : 2023**, **IS 18256 : 2023** and **IRC : 137 - 2022**

14. What lengths do GFRP Rebars come in?

GFRP Rebars come in standard length of 12 meters. But since we can coil them, we can make custom lengths of up to 5kms* which helps save in your overlapping cost.

15. Are GFRP Rebars brittle?

Yes, GFRP Rebars are brittle in nature but only break or snap at a tensile strength of 1000+ megapascal.

16. What precautions should I take while using GFRP Rebars?

While handling the material and using GFRP Rebars, it is advised to wear safety hand gloves since GFRP Rebars are made from Fiberglass, they have small threads which may cause irritation if used with bare hands.

17. Are GFRP Rebars used in India? Are they a success for reinforcement?

The rebar revolution of GFRP Rebars began in 2019 by MRG Composites in India. We started the wave and now the growth and usage of the material will grow exponentially in India in the coming future since the Bureau of Indian Standard has published its own standards.

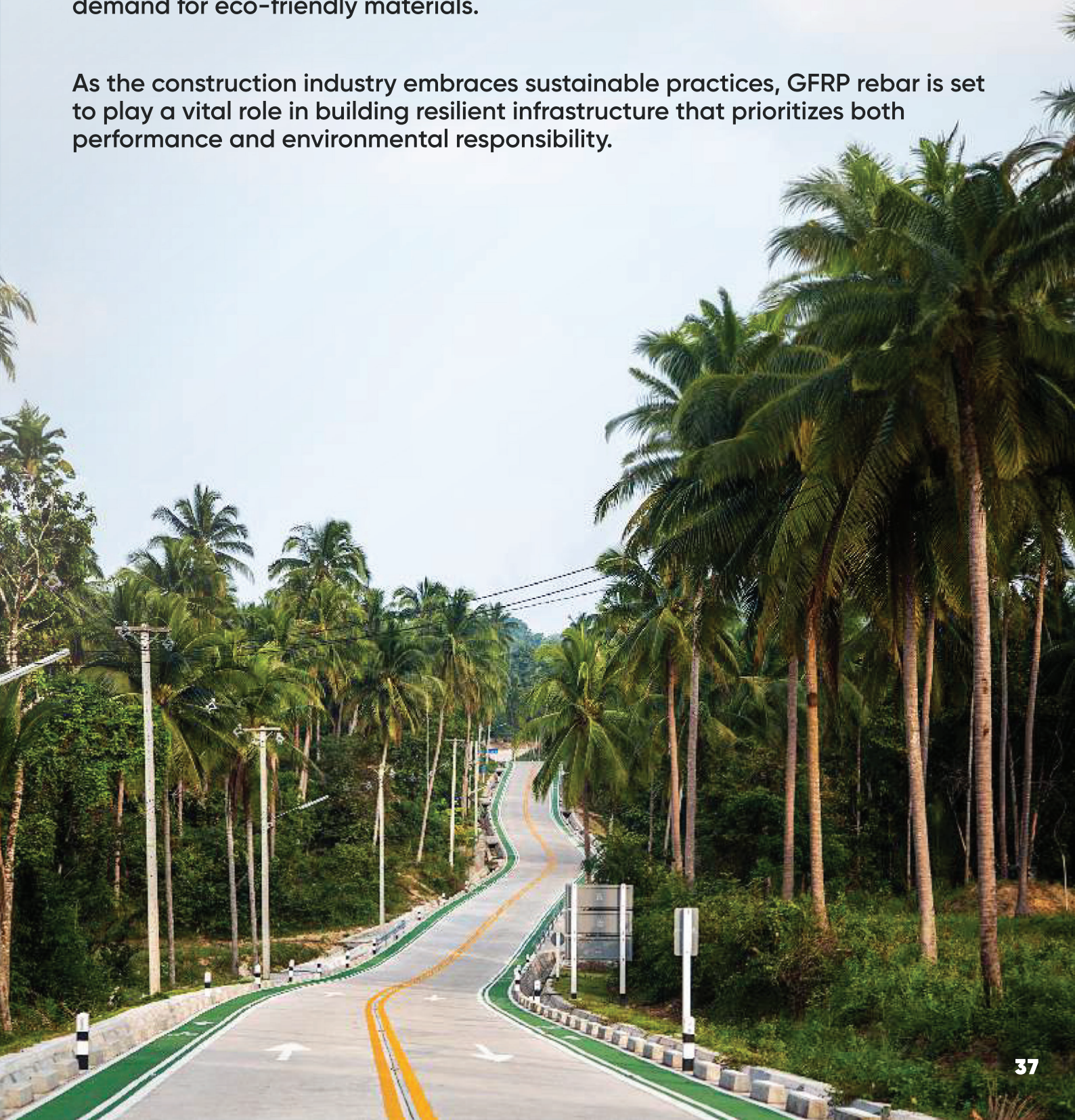
18. What method is used for testing of GFRP Rebars? How are GFRP Rebars tested?

GFRP Rebars are tested in a different way to the metal rebars. In the case of GFRP Rebars, couplers/grippers are to be installed on both end of the Rebars to perform major tests like tensile. Further details on testing are mentioned in test methods in IS 18255:2023

GFRP rebar is a sustainable construction solution that requires less energy to produce, significantly reducing environmental impact. Its corrosion resistance ensures durability and minimizes maintenance.

Additionally, GFRP's lightweight nature leads to cost savings in transportation and labor. Many manufacturers seek sustainability certifications to meet the demand for eco-friendly materials.

As the construction industry embraces sustainable practices, GFRP rebar is set to play a vital role in building resilient infrastructure that prioritizes both performance and environmental responsibility.



Credific Ventures Pvt Ltd

India Office

Plot No. 8B & 8C
Sector-3, Industrial Area
Pithampur (M.P.), India
+919530013034
hello@rebarx.in

Overseas Office

Ammetal Trading FZX LLC
Ajman Media Free Zone
Dubai
+971569576861
pushkar@ammetail.ae

Gujarat Office

410/Fourth Floor, AR Mall,
Panvel Point, Nr.Sudama
Chowk, Mota varachha,
Surat, Gujrat-394101.
+91 8347575331
Shreeglassfiber@gmail.com



Approved By



सड़क परिवहन
एवं राजमार्ग मंत्रालय
MINISTRY OF
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