

FIBERNOX[®] V-ROD GFRP reinforcement

Technical information



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FIBERNOX® V-ROD

Product description

FIBERNOX® V-ROD is a fibre composite concrete reinforcement bar designed for maximum strength and durability. High-quality, corrosion-resistant glass fibres and a highly durable vinyl ester resin are processed using a pultrusion process to produce straight or curved reinforcing bars. The sand-coated surface forms the best possible bond with the concrete and encloses all glass fibres. In numerous areas of application, FIBERNOX® V-ROD forms a technically and economically beneficial alternative to reinforcing steel and stainless steel reinforcement. FIBERNOX® V-ROD rebar has been used successfully around the world for many decades.



Benefits

- Durable even in extreme conditions
- Resistant to corrosion and alkalis
- Very high tensile strength and low weight
- Electrically non-conductive and permeable for radio frequencies
- Non-magnetic
- Very low thermal conductivity
- Easily cut by tunnel boring machines
- Excellent bond and outstanding durability thanks to sand-coated surface
- Various diameters and shapes available

Product range

FIBERNOX® V-ROD is available in the following variants:

- Straight rods
- Curved rods of many different shapes
- Straight rods with end anchors
- Shear dowels with smooth surfaces
- Rock bolts with pressure plates and nuts

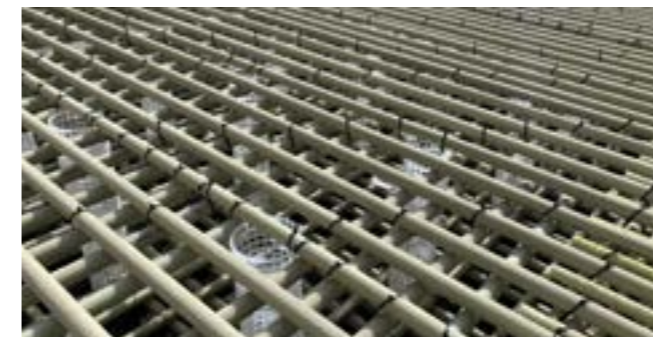
Areas of application

General

The benefits and properties of FIBERNOX® V-ROD listed above allow it to be used in, for example, the following applications in reinforced concrete and prefabricated construction projects:

- **Projects with high durability requirements due to aggressive environmental conditions.** FIBERNOX® V-ROD is a very economical and highly durable alternative to stainless steel reinforcement thanks to its composition. It consists of vinyl ester resin and corrosion-resistant glass fibres, which are additionally protected by the sand-coated surface. FIBERNOX® V-ROD is more economical than stainless steel. It is also more economical than reinforcing steel, which requires corrosion-preventing measures, such as thick concrete cover, additives and admixtures and expensive special concrete. **Applications:** Coastal and marine construction, foundations, concrete tanks for the chemical industry, sewage and seawater desalination plants
- **Thin, slender components that inevitably require a thin concrete cover.** The concrete cover required for FIBERNOX® V-ROD is only the rod diameter + 10 mm. This allows slender prefabricated parts to be produced without compromising on durability. **Applications:** Prefabricated construction
- **Projects requiring electrically or magnetically non-conductive reinforcement.** **Applications:** Railway construction, airport construction, transformer buildings, hospitals, aluminium factories, energy-neutral housing construction
- **Projects where low thermal conductivity is an advantage.** The specific thermal conductivity of FIBERNOX® V-ROD is only 0.5 W/mK. This is 30 to 100 times lower than that of stainless steel or steel reinforcement. **Applications:** Insulated prefabricated sandwich and double walls
- **Projects in which tunnel boring machines (TBM) are used.** FIBERNOX® V-ROD is used in breakthrough areas (soft eyes) in tunnel and underground metro construction projects and can be easily cut by TBMs. As FIBERNOX® reinforcement can be cut, it prevents any damage to the cutting wheels of the TBM. It also eliminates the need for expensive and time-consuming additional measures, such as manual concrete excavation and ground stabilisation injections.

Application examples



Floor slab of physics laboratory, University of Zurich-Irchel, Switzerland



Installing FIBERNOX® V-ROD in bridge deck and concrete guard rails



FIBERNOX® V-ROD used as a non-conductive floor slab reinforcement for new hospital construction



Tramway cover plates, Magdeburg, Germany

General information

Manufacturer of FIBERNOX® V-ROD

The Canadian manufacturer PULTRALL has decades of experience in producing FIBERNOX® V-ROD. They are world leaders in manufacturing composite materials due to their unsurpassed product quality, innovative ability and dynamism.

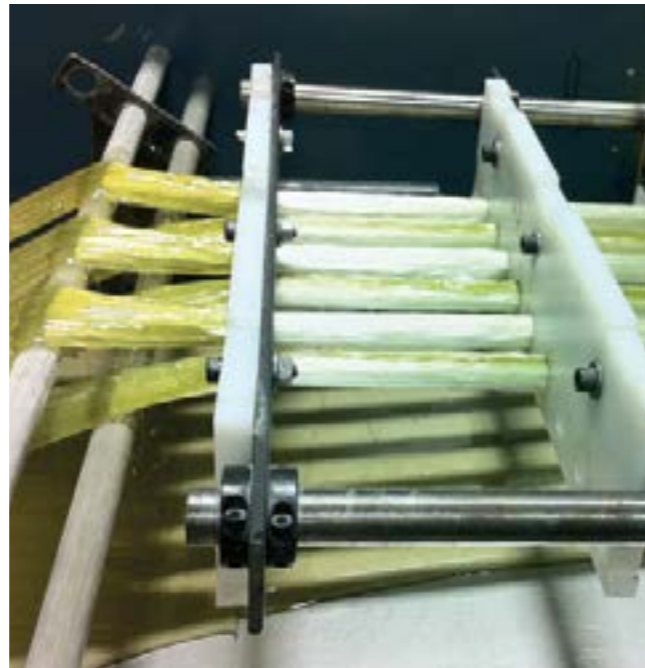
H-BAU Technik is a stock-keeping engineering partner for Europe and is equally renowned as a reliable specialist for innovative components of matchless quality. Both PULTRALL and H-BAU Technik are ISO 9001 certified. Both straight and curved FIBERNOX® V-ROD rebar versions are certified in line with the internationally recognised CSA 807 standard.



Reinforcement cages made of straight and spiral FIBERNOX® V-ROD reinforcement

The manufacturing process

FIBERNOX® V-ROD rebar is manufactured using the pultrusion process. This involves pulling a number of glass fibres, defined by the rod diameter, through a die under high tensile force. The bundle is completely saturated with vinyl ester resin, the surface is coated with sand and then the rods are cured to form a single-piece building material. Straight or curved reinforcing bars are produced using different manufacturing processes.

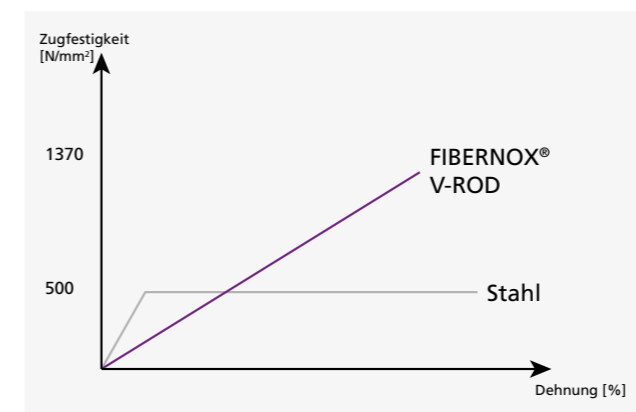


Manufacturing FIBERNOX® V-RODs using the pultrusion process

Technical information

FIBERNOX® V-ROD 60

| Type | 6 | 8 | 10 | 12 | 16 | 20 | 25 | 32 |
|---|--------|--------|--------|--------|--------|--------|--------|--------|
| Nominal diameter mm | 6 | 8 | 10 | 12 | 16 | 20 | 25 | 32 |
| Nominal cross section mm ² | 28.3 | 50.3 | 78.5 | 113.1 | 201.1 | 314.2 | 490.9 | 804.2 |
| Outside diameter mm | 7.7 | 9.8 | 11.8 | 13.8 | 18.2 | 22.1 | 27.3 | 34.4 |
| Guaranteed tensile strength N/mm ² | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 |
| Modulus of elasticity N/mm ² | 60,000 | 60,000 | 60,000 | 60,000 | 60,000 | 60,000 | 60,000 | 60,000 |
| Bond stress N/mm ² | >14.0 | >14.0 | >14.0 | >14.0 | >14.0 | >14.0 | >14.0 | >14.0 |
| Bond coefficient in line with ACI 440 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 |
| Shear load capacity N/mm ² | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 |
| Axial coefficient of thermal expansion Kx10 ⁶ | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 |
| Radial coefficient of thermal expansion Kx10 ⁶ | 23.8 | 23.8 | 23.8 | 23.8 | 23.8 | 23.8 | 23.8 | 13.000 |
| Glass content % by volume | 66 | 66 | 66 | 66 | 66 | 66 | 66 | 66 |
| Glass content % by weight | 83 | 83 | 83 | 83 | 83 | 83 | 83 | 83 |
| Specific weight t/m ³ | 2.1 | 2.1 | 2.1 | 2.1 | 2.1 | 2.1 | 2.1 | 2.1 |
| Weight per metre kg/m | 0.07 | 0.12 | 0.18 | 0.26 | 0.45 | 0.7 | 1.09 | 1.78 |



Mechanical properties

- Linear-elastic stress-strain behaviour up to a breaking stress of well over 1,000 N/mm²
- Double or triple the tensile strength of steel and stainless steel reinforcement
- Modulus of elasticity is 3 times lower than that of steel reinforcement

Design

- It is essential to consider the mechanical properties listed above when designing FIBERNOX® V-ROD structures
- The current internationally recognised standard for GFRP reinforcement design is CSA-806.
- Please contact us for related information

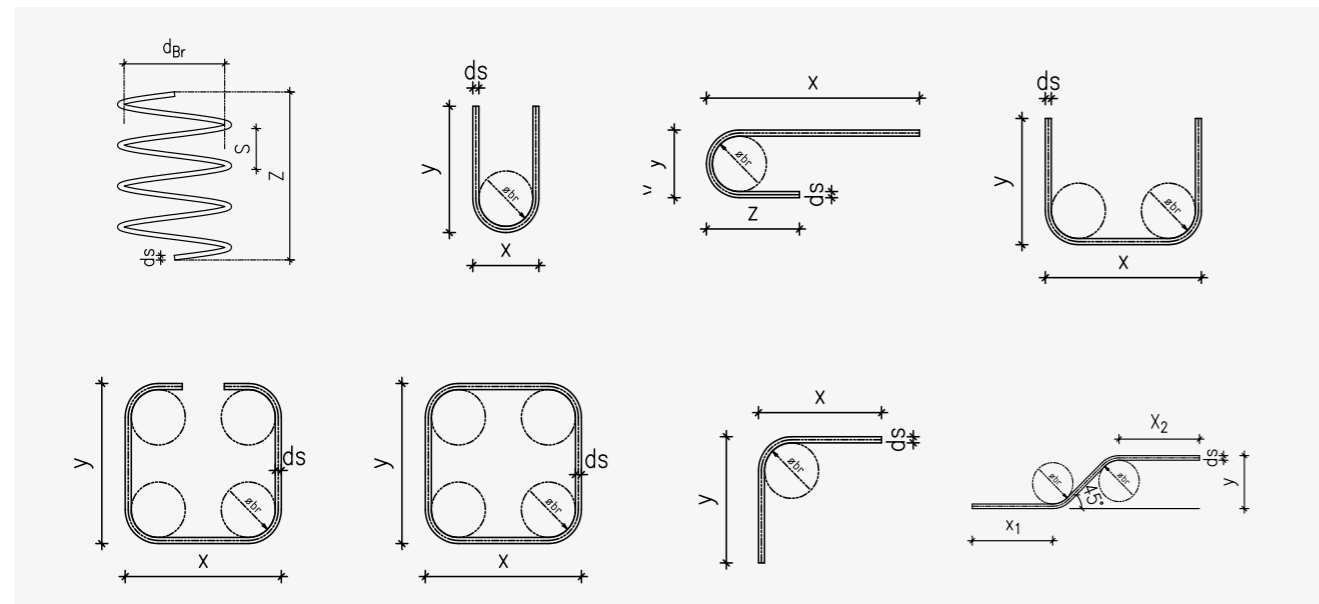
Curved shapes

FIBERNOX® V-ROD curved rods

| Type | 10 | 12 | 16 | 20 | 25 | 32 |
|---|--------|--------|--------|--------|--------|--------|
| Nominal diameter mm | 10 | 12 | 16 | 20 | 25 | 32 |
| Nominal cross section mm ² | 71.26 | 126.68 | 197.93 | 285.02 | 387.95 | 506.71 |
| Total cross-section with sand coating mm ² | 81.6 | 145.7 | 240 | 332.96 | 439.4 | 582.72 |
| Guaranteed tensile strength of straight rod N/mm ² | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 |
| Guaranteed tensile strength of curved rod N/mm ² | 450 | 450 | 450 | 450 | 450 | 450 |
| Modulus of elasticity N/mm ² | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 |
| Glass content % by weight | 78 | 78 | 78 | 78 | 78 | 78 |
| Weight per metre kg/m | 0.167 | 0.292 | 0.443 | 0.651 | 0.887 | 1.136 |

- FIBERNOX® V-ROD curved rods are available in diameters of 6, 8, 10, 12, 16, 20, 22, 25, 32 mm and intermediate diameters.
- Please read the detailed guidelines for FIBERNOX® V-ROD curved rods available from www.pohlcon.com
- The bending roller radius is 4 ds

Possible curved shapes



End anchors



| Type | Diameter mm |
|-------|-------------|
| E4/12 | 12 |
| E5/16 | 16 |
| E6/20 | 20 |

FIBERNOX® V-ROD can also be equipped with end anchors in diameters from 12 to 20 mm.

Shear dowels with smooth surfaces



- Shear dowels are available in different lengths
- Stock length 11,900 mm

| Type | 25 | 28 | 32 | 35 | 38 | 41 | 45 |
|--|-------|-------|-------|-------|--------|--------|--------|
| Nominal diameter mm | 25.4 | 28.6 | 31.8 | 34.9 | 38.1 | 41.3 | 45.5 |
| Nominal cross section mm ² | 506.7 | 642.4 | 794.2 | 956.6 | 1140.1 | 1339.8 | 1555.3 |
| Guaranteed shear force capacity N/mm ² | 160 | 160 | 160 | 160 | 160 | 160 | 160 |
| Glass content % by weight | 81 | 81 | 81 | 81 | 81 | 81 | 81 |
| Weight per metre kg/m | 1.028 | 1.354 | 1.61 | 1.925 | 2.307 | 2.708 | 3.137 |

Rock bolts



- Complete system with pressure plate and nut
- Left-hand and right-hand threads available
- Standard length 3 m, other lengths available

| Type | 25 | 28 | 32 | 35 | 38 | 41 | 45 |
|--|-------|-------|-------|-------|--------|--------|--------|
| Nominal diameter mm | 25.4 | 28.6 | 31.8 | 34.9 | 38.1 | 41.3 | 45.5 |
| Nominal cross section mm ² | 506.7 | 642.4 | 794.2 | 956.6 | 1140.1 | 1339.8 | 1555.3 |
| Guaranteed shear force capacity N/mm ² | 160 | 160 | 160 | 160 | 160 | 160 | 160 |
| Glass content % by weight | 81 | 81 | 81 | 81 | 81 | 81 | 81 |
| Weight per metre kg/m | 1.028 | 1.354 | 1.61 | 1.925 | 2.307 | 2.708 | 3.137 |

Applications



Construction of a new taxiway
Zurich Airport, Switzerland



Creative concrete forecourt
Haus der Musik, Innsbruck, Austria



Tanks for sewage treatment plant, floor slab reinforcement
Thetford Mines, Québec, Canada



Tanks for sewage treatment plant, wall and floor slab
reinforcement
Thetford Mines, Québec, Canada



Bored piles in the Wildpark excavation pit
Future train station, Bern, Switzerland



La Chancelière underground car park
Québec City, Canada



Refurbishment of bridge supports in salt water
Florida, USA



Coastal defence with 1,800 bored piles
Flagler Beach, Florida, USA



Reinforcement of the research buildings in the Undulator Hall
European XFEL GmbH, Schenefeld, Germany



Ceiling slab reinforcement
European XFEL GmbH, Schenefeld, Germany



Impact test of a 36,000-kg truck travelling at 80 km/h against a
standard crash barrier reinforced with FIBERNOX® V-ROD



Diaphragm wall of motorway enclosure
Schwamendingen, Switzerland



Diaphragm wall of motorway enclosure
Schwamendingen, Switzerland

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PohlCon GmbH

Nobelstrasse 51
12057 Berlin, Germany

T +49 30 68283-04
F +49 30 68283-383

www.pohlcon.com