

# FIBERNOX<sup>®</sup> V-ROD GFRP reinforcement

Technical information





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# FIBERNOX<sup>®</sup> V-ROD

## Product description

FIBERNOX<sup>®</sup> 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<sup>®</sup> V-ROD forms a technically and economically beneficial alternative to reinforcing steel and stainless steel reinforcement. FIBERNOX<sup>®</sup> V-ROD rebar has been used successfully around the world for many decades.

## Product range

FIBERNOX<sup>®</sup> 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



## 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

## 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.

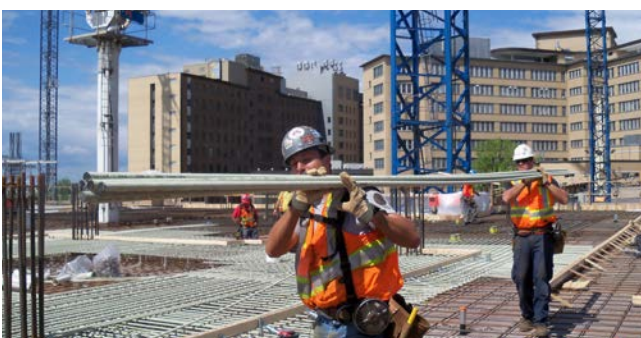
## Application examples



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.

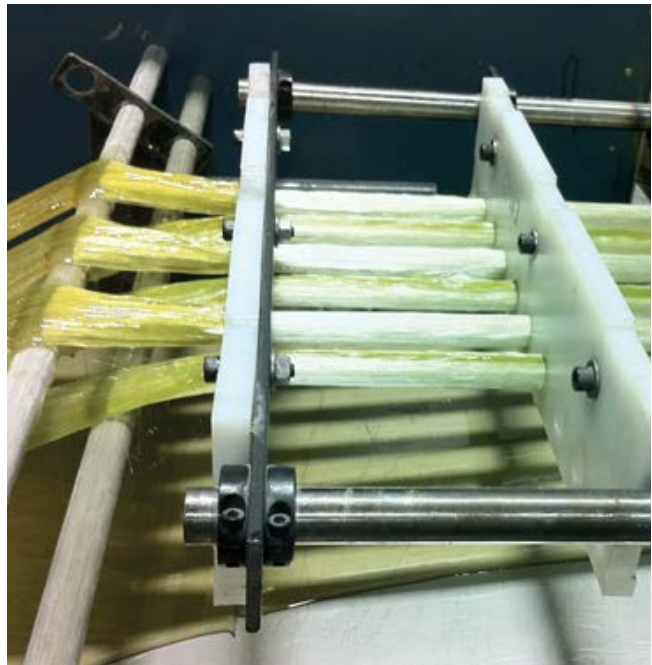
H-BAU Technik is a stock-keeping engineering partner for Europe and is equally renowned as a reliable specialist for innovative components of matchless quality. Both PULTRALL and H-BAU Technik are ISO 9001 certified. Both straight and curved FIBERNOX® V-ROD rebar versions are certified in line with the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



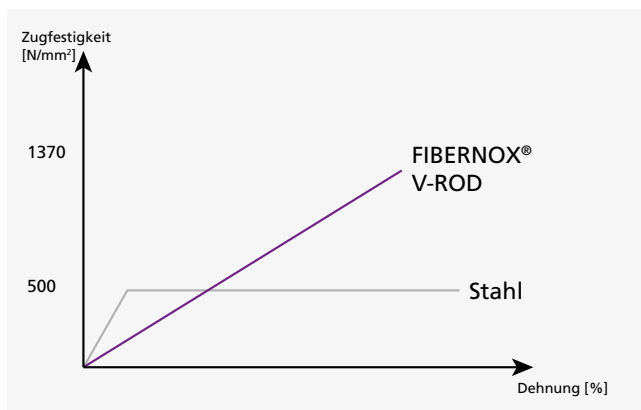
Manufacturing FIBERNOX® V-RODs using the pultrusion process

# Technical information

## FIBERNOX® V-ROD 60

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

Diameters 35, 38 and 40 mm are available on request



### Mechanical properties

- Linear-elastic stress-strain behaviour up to a breaking stress of well over 1,000 N/mm<sup>2</sup>
- 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

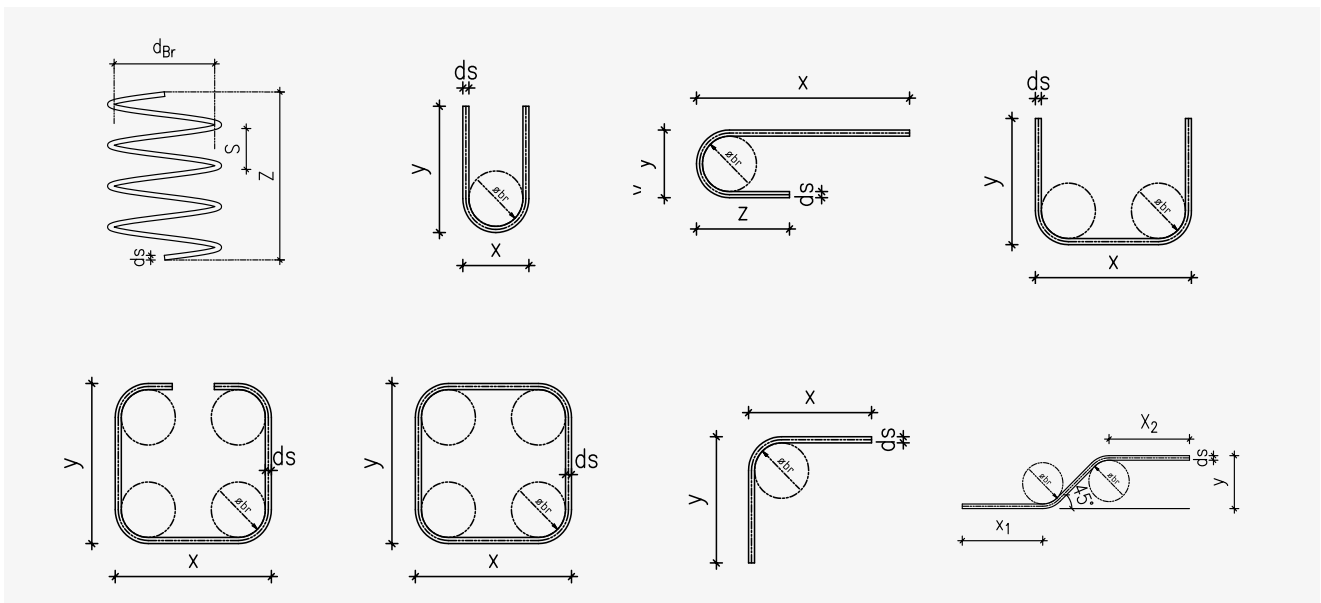
# Curved shapes

## FIBERNOX® V-ROD curved rods

Type	6	10	12	16	20	25	32
<b>Nominal diameter</b> mm	6	10	12	16	20	25	32
<b>Nominal cross section</b> mm <sup>2</sup>	32.00	71.26	126.68	197.93	285.02	506.71	819.00
<b>Total cross-section with sand coating</b> mm <sup>2</sup>	42.00	81.60	145.70	240.00	332.96	582.72	848.00
<b>Guaranteed tensile strength of straight rod</b> N/mm <sup>2</sup>	1,000	1,000	1,000	1,000	1,000	1,000	1,000
<b>Guaranteed tensile strength of curved rod</b> N/mm <sup>2</sup>	450	450	450	450	450	450	450
<b>Modulus of elasticity</b> N/mm <sup>2</sup>	50,000	50,000	50,000	50,000	50,000	50,000	50,000
<b>Glass content</b> % by weight	78	78	78	78	78	78	78
<b>Weight per metre</b> kg/m	0.08	0.17	0.29	0.44	0.65	0.89	1.91

- FIBERNOX® V-ROD curved rods are available in diameters of 6, 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](http://www.pohlcon.com)
- The bending roller radius is 4 ds

## Possible curved shapes





## End anchors



Type	Diameter mm
E 4/12	12
E 5/16	16
E 6/20	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 <sup>2</sup>	506.7	642.4	794.2	956.6	1140.1	1339.8	1555.3
Guaranteed shear force capacity N/mm <sup>2</sup>	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 <sup>2</sup>	506.7	642.4	794.2	956.6	1140.1	1339.8	1555.3
Guaranteed shear force capacity N/mm <sup>2</sup>	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



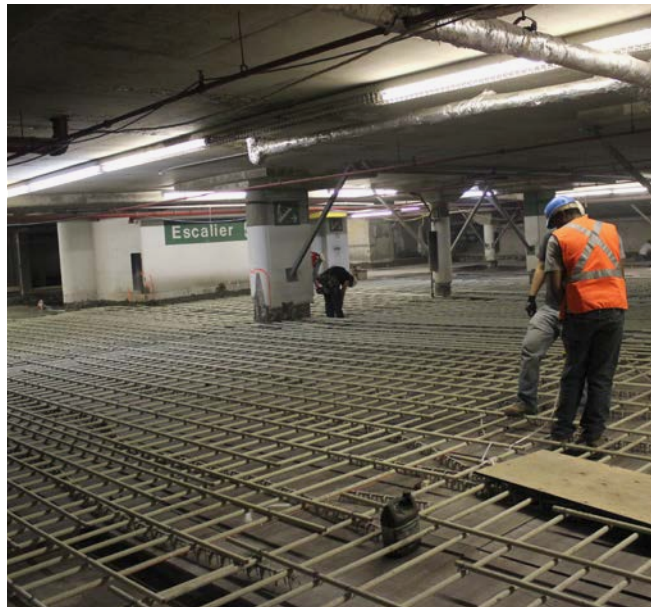
Construction of a new taxiway  
Zurich Airport, Switzerland



Creative concrete forecourt  
Haus der Musik, Innsbruck, Austria



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



La Chancelière underground car park  
Québec City, Canada



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



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



Diaphragm wall of motorway enclosure  
Schwamendingen, Switzerland



Diaphragm wall of motorway enclosure  
Schwamendingen, Switzerland



Ground slab and column reinforcement as well as punching shear reinforcement  
Fusion energy research project Tokamak in Prague,  
Czech Republic



Ground slab and punching shear reinforcement  
Fusion energy research project Tokamak in Prague,  
Czech Republic



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

# Our synergy concept for your benefit

**With us, you can take advantage of the collective experience of three established manufacturers that combine products and expertise in one comprehensive offer. That is the PohlCon synergy concept.**



## **Full service consulting**

Our extensive network of consultants is available to answer all of your questions about our products on site. From planning to deployments, enjoy personal support from our qualified professionals.



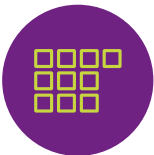
## **Digital solutions**

Our digital offerings offer targeted support in planning with our products. From tender texts through CAD details and BIM data to modern software solutions, we offer you tailored support for your planning.



## **7 areas of application**

We think in holistic solutions, which is why we have grouped our products into seven areas of application for you where you can benefit from the synergy of the PohlCon product portfolio.



## **10 product categories**

To help you find the right product in our extensive range even faster, the products are grouped into ten product categories so you can navigate clearly between our products.



## **Individual special solutions**

There's no mass produced-product on the market that is suitable for your project? We master extraordinary challenges with the many years of expertise of our three manufacturing brands in the sector of individual solutions, allowing us to realize your unique construction projects together.



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