V-ROD

COMPOSITE REBAR FOR CONCRETE STRUCTURES

REVOLUTION IN CONCRETE CONSTRUCTION

PULTRALL

V-ROD USA

DURABILITY CORROSION RESISTANCE

V·ROD does not rust, even in the harshest environments. It does not react with salt, chemical products, or the alkalinity of the concrete. Structures exposed to de-icing salts, sea water, or chemical products have a significantly longer service life when reinforced with V·ROD rebars.

V·ROD is ideal for bridges, concrete pavements, bridge decks, bridge curbs, pier caps, abutments, sidewalks, barrier walls, sound barriers, airport runways, water treatment plants, sea walls, wave breakers, piers and jetties, harbours, parking garages, salt storage facilities, swimming pools, industrial floors, desalination intakes, substations, etc.

RESILIENT

EASILY CUT

V·ROD is easily machined and cut. It will not damage concrete saws nor boring machines. V·ROD is ideal for soft-eyes, diaphragm walls, drilled pile walls, formwork anchors, temporary structures, rock anchors, soil nails, etc.

LIGHTWEIGHT

4X LIGHTER THAN STEEL

V·ROD is up to four (4) times lighter than steel rebar. It is much easier to handle, reduces installation time, and requires fewer transports to bring the material to site. V·ROD is ideal for remote region structures, precast elements, and where large diameter bars are required.

STRENGTH

2.5 X STRONGER THAN STEEL

V·ROD is stronger than steel. Depending on its grades, V·ROD offers more than three (3) times the tensile strength of steel rebars. V·ROD is ideal for heavily solicited elements like barrier walls, two-way slabs, etc.

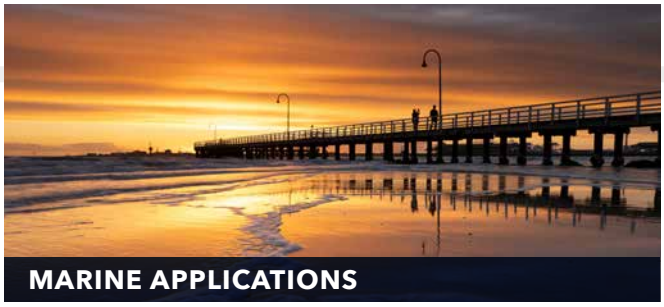
ELECTROMAGNETIC NEUTRALITY

V·ROD does not contain any metal and will not cause any interference when placed within strong magnetic fields or where sensitive electronic instruments are operated nearby. V·ROD is ideal for MRI machine pads in hospitals, research facilities, aluminium smelters, industrial facilities, electrical underground enclosures, switchyards, toll roads, monorail tracks, etc.

TRANSPORTATION

TUNNELS

MINING



MARINE APPLICATIONS

WATER TREATMENT

INDUSTRIAL APPLICATIONS

CIVIL ENGINEERING

ARCHITECTURE

BUILDING STRUCTURES

ELECTROMAGNETIC

V·ROD 46

GLASS FIBER REINFORCED POLYMER (GFRP) REBAR

		#2 (6 M)	#3 (10 M)	#4 (12 M)	#5 (15 M)	#6 (20 M)	#7 (22 M)	#8 (25 M)	#9 (30 M)	#10 (32 M)
Guaranteed tensile strength* (ASTM D7205)	MPa	950	950	950	950	950	950	850	850	800
	ksi	137.8	137.8	137.8	137.8	137.8	137.8	123.3	123.3	116
Minimum tensile modulus (ASTM D7205)	GPa	46								
	ksi	6800								
Guaranteed transverse shear capacity (ASTM D7617)	MPa	160								
	ksi	23.2								
Resin		Vinylester								
Weight	g/m	73.4	148	255	400	575	769	1012.6	1269	1567
	lb/ft	0.049	0.099	0.171	0.269	0.386	0.516	0.680	0.852	1.052
Effective cross-sectional area (including sand coating)** (CSA S806 Annex A)	mm^2	33.9	69.7	121.2	191.1	270.7	366.7	483.9	609.4	756.2
	in^2	0.053	0.108	0.188	0.296	0.420	0.569	0.750	0.945	1.172
Effective diameter	mm^2	6.6	9.4	12.4	15.6	18.6	21.6	24.8	27.9	31.0
	in^2	0.259	0.371	0.489	0.614	0.731	0.851	0.977	1.097	1.222
Nominal cross-sectional area (CSA S807 Table 1)	mm^2	32	71	129	199	284	387	510	645	819
	in^2	0.050	0.110	0.199	0.308	0.440	0.599	0.790	1	1.269

* The nominal guaranteed tensile strength must not be used to calculate the strength of the bent portion of a bent bar. Instead, use the minimum guaranteed tensile strength found in the technical data sheet of bent V·ROD bars.

** Please contact Pultrall for dowelling applications.

Development and splice length are available upon request but should be determined by the design engineer.

The guaranteed value presented in this document is the mean value minus 3 times the standard deviation.

It is the responsibility of the design engineers to contact the bar manufacturer to get the latest updates of this technical data sheet (also available at www.vrod.ca). For any additional technical reports or literature, please contact Pultrall.

V·ROD 60

GLASS FIBER REINFORCED POLYMER (GFRP) REBAR

Product Data Sheet - V·ROD 60		#2 (6 M)	#3 (10 M)	#4 (12 M)	#5 (15 M)	#6 (20 M)	#7 (22 M)	#8 (25 M)	#9 (30 M)	#10 (32 M)
Guaranteed tensile strength* (ASTM D7205)	MPa	1100	1100	1100	1100	1100	1100	1000	1000	1000
	ksi	159.5	159.5	159.5	159.5	159.5	159.5	145	145	145
Minimum tensile modulus (ASTM D7205)	GPa	60								
	ksi	8702.3								
Guaranteed transverse shear capacity (ASTM D7617)	MPa	180								
	ksi	26.1								
Resin		Vinylester								
Weight	g/m	78	182	315	498	704	933	1180	1426	1867
	lb/ft	0.052	0.122	0.212	0.334	0.473	0.627	0.792	0.958	1.254
Effective cross-sectional area (including sand coating)** (CSA S806 Annex A)	mm^2	41.3	85.8	147.0	231.6	328.0	448.8	566.7	724.3	878.5
	in^2	0.064	0.133	0.228	0.359	0.509	0.696	0.879	1.123	1.362
Effective diameter	mm^2	7.3	10.5	13.7	17.2	20.4	23.9	26.9	30.4	33.4
	in^2	0.286	0.412	0.539	0.676	0.805	0.941	1.058	1.197	1.317
Nominal cross-sectional area (CSA S807 Table 1)	mm^2	32	71	129	199	284	387	510	645	819
	in^2	0.05	0.110	0.20	0.31	0.440	0.6	0.790	1	1.269

* The nominal guaranteed tensile strength must not be used to calculate the strength of the bent portion of a bent bar. Instead, use the minimum guaranteed tensile strength found in the technical data sheet of bent V·ROD bars.

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DIRECT COMPARISON BETWEEN STEEL AND V·ROD

MATERIAL PROPERTIES	UNITS	V-ROD	STAINLESS STEEL (ASTM A955)	STEEL (ASTM A615)
Tensile strength [1]	PSI	116000 - 189000	60000	60000
	MPa	800 - 1300	420	420
Modulus of elasticity	KSI	675 - 8700	29000	29000
	GPa	46 - 60	200	200
Bond strength	PSI	2 000	1450 [2]	1450 [2]
	MPa	14	10 [2]	10 [2]
Thermal conductivity	BTU/(hr·ft·°F)	< 0.6 [2]	10 [2]	32 [2]
	W/ (m·°C)	< 1 [2]	16 [2]	54 [2]
Electrical resistivity	Ω·in	$>10^{11}$ [2]	4x10-5 [2]	6x10-6 [2]
	Ω·cm	$>10^{11}$ [2]	1x10-4 [2]	1.5x10-5 [2]
Unit weight	lb/ft^3	110 - 130	485 - 500	490
	kg/m^3	1750 - 2100	7800 - 8000	7850
Required concrete cover [3]	in	34	11/2-3	11/2-3
	mm	20	25 - 75	25 - 75

[1] Guaranteed tensile strength for V-ROD bars, yield strength for stainless and black steel bars
[2] Approximate value
[3] For exposed conditions, as per ACI 440.5 and ACI 318

DESIGN GUIDES AND CODES

V·ROD composite reinforcing bars are included in the scope of various Design Guides and Design Codes:

CANADA

CAN/CSA S806: Design of Buildings with Fiber-Reinforced Polymers
CAN/CSA S6: Canadian Highway Bridge Design Code
CAN/CSA S807: Specification for fiber-reinforced polymers

USA

ACI 440.1R: Guide for the Design and Construction of Structural Concrete Reinforced with FRP Bars
ACI 440.11: Building Code Requirements for Structural Concrete Reinforced with Glass Fiber-Reinforced Polymer (GFRP) Bars–Code and Commentary
AASHTO LRFD: Bridge Design Specifications for GFRP-Reinforced Concrete Bridge Decks and Traffic Railing
AASHTO LRFD Bridge Design Guide Specifications for GFRP-Reinforced Concrete

EUROPE

FIB Task Group 9.3 - Bulletin 40 - FRP Reinforcement in RC Structures
CNR DT 203 - Guide for the Design and Construction of Concrete Structures Reinforced with Fiber-Reinforced Polymer Bars
AFGC: Utilisation d'armatures composites (à fibres longues et à matrice organique) pour le béton armé

AVAILABILITY

V·ROD FRP reinforcing bars are available in various sizes from #2 (6M) to #14 (45M)
For an easier and faster installation, bends are factory-made, ready-to-use and shipped directly to site.
V·ROD is available with Glass Fibers.

TECHNICAL SUPPORT

Is your design already done with steel reinforcement?

Share it with us and our team of civil engineers will convert it to **V•ROD** and provide a cost comparison for your project.

Also available is customized training in the engineering design of concrete structures reinforced with composite materials to fit your needs.

Contact ENGINEERING@FIBERGLASSREBAR.COM

A WORD ABOUT PULTRALL:

Established in 1987, Pultrall Inc. is the pioneer of non-metallic concrete reinforcement solutions in North America. Pultrall's achievements include some of the most prestigious projects in North America and around the world. The company serves customers through a network of authorized distributors throughout North America, Latin America, Europe, Australia, and the Middle East.

AT PULTRALL, WE BELIEVE IN CHALLENGING THE STATUS QUO.

We are convinced that the safety and durability of concrete structures can be achieved by eliminating corrosion at its roots. Our solution is a stronger, thoroughly characterized, widely used, and corrosion- free reinforcement that advantageously replaces the quickly corroded steel rebar. Our solution with V•ROD!

V•ROD

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