



Vitrulan
Composites



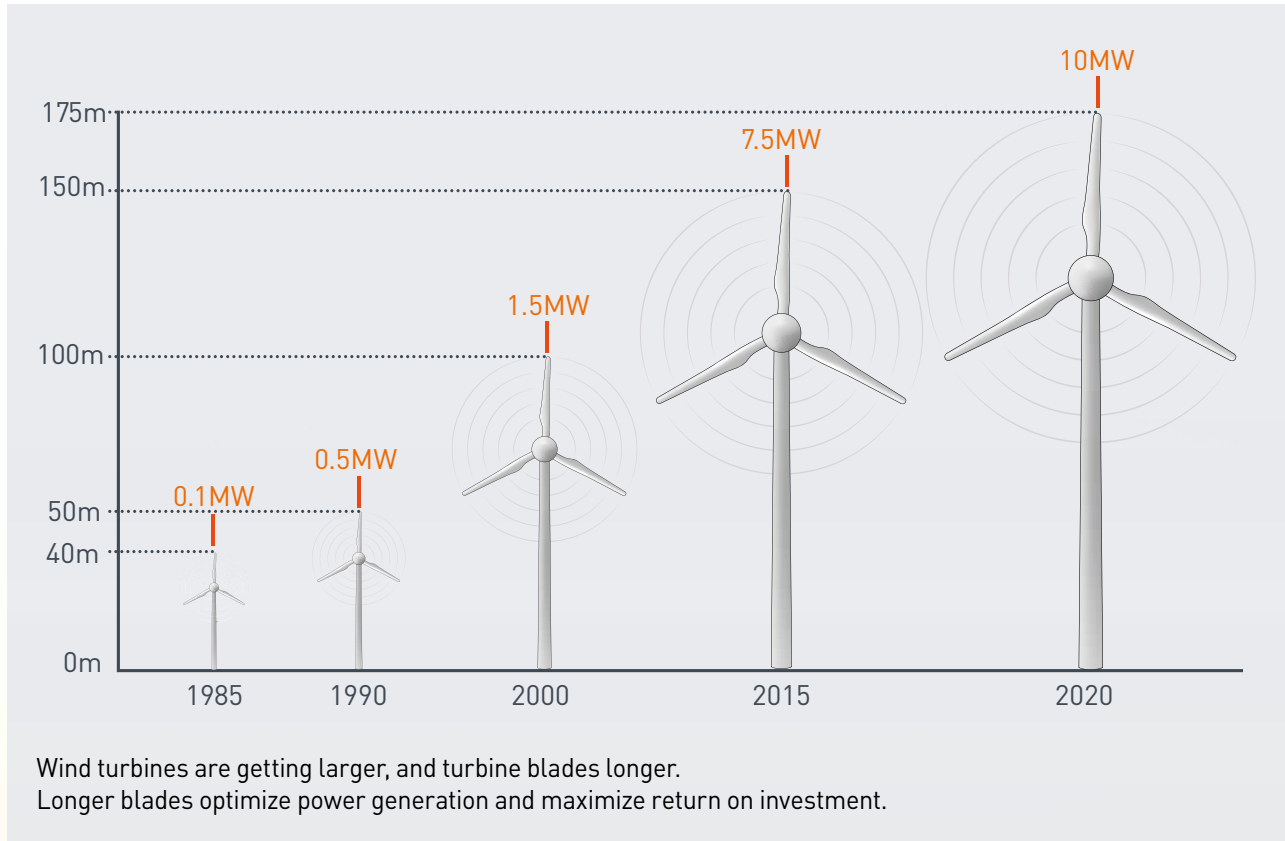
HighFlow
by Vitrulan

WIND ENERGY

New, unrivalled performance for manufacturing
lightweight wind turbine blades

VITRULAN HIGHFLOW WIND ENERGY

HighFlow by Vitrulan is an innovative fabric which optimizes resin infusion permeability, helping designers and manufacturers deliver better, lightweight turbine blades.



KEY MARKET REQUIREMENTS

- Efficient resin infusion
- Complete resin wet out
- Minimal air voids
- Ability for above characteristics to be integrated into any fabric



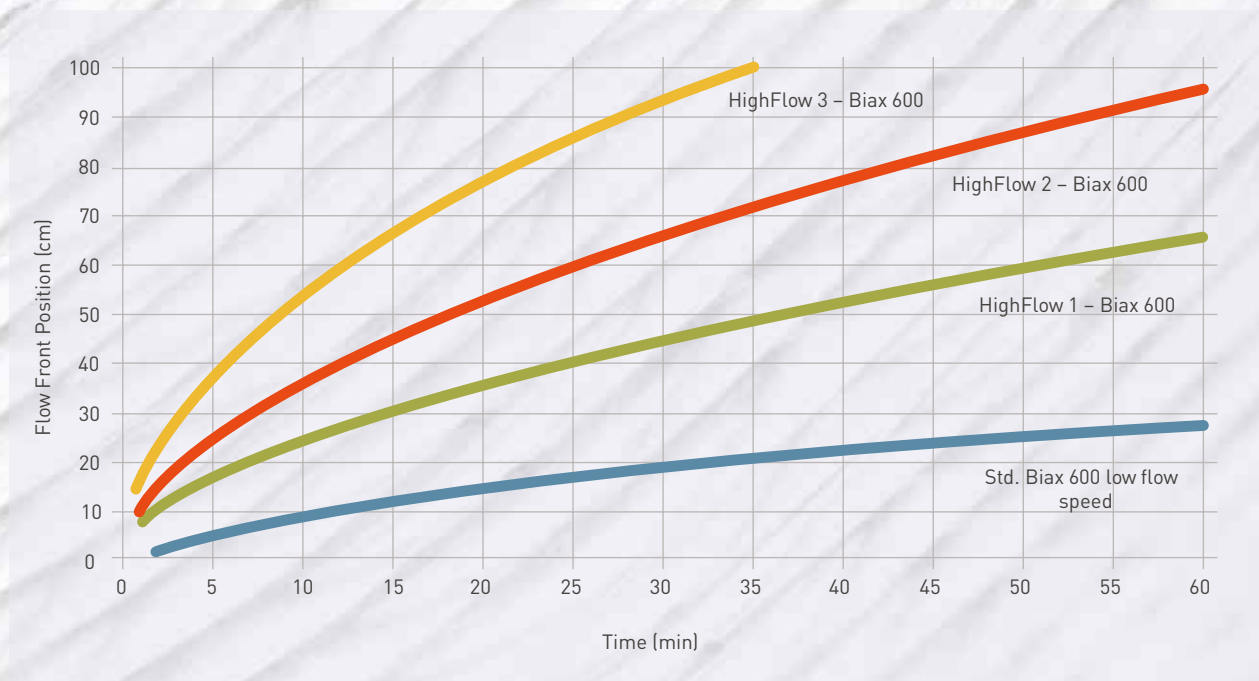
VITRULAN HIGHFLOW WIND ENERGY

As blades become larger and laminates thicker, the infusion process becomes critical. HighFlow by Vitrulan is the solution.

THE BENEFITS OF HIGHFLOW BY VITRULAN

- | Delivers complete fabric wet out, minimizing air voids
- | Maximises resin infusion, with process speeds up to 300% faster for the entire laminate construction
- | Customises infusion speed, without any restrictions to product construction and weight
- | Reduces total cost of ownership by up to 15%

COMPARISON TABLE OF HIGHFLOW BY VITRULAN BIAx 600 RANGE – STANDARD, E1, E2 & E3



UD FABRICS

BENEFITS

- Delivers complete fabric wet out, minimizing air voids
- Maximises resin infusion, with process speeds up to 300% faster for the entire laminate construction
- Customises infusion speed, without any restrictions to product construction and weight
- Reduces total cost of ownership by up to 15%
- UD is available with E-glass fiber, High Modulus fiber and Carbon fiber

HIGHFLOW BY VITRULAN UD 1350 FABRIC (HIGH MODULUS FIBER)

GRADE CODE	BASIS WEIGHT (g/m ²)	RESIN FLOW SPEED
HighFlow 1 UD1350 HM glass fiber	1400	Fast
HighFlow 2 UD1350 HM glass fiber	1400	Faster

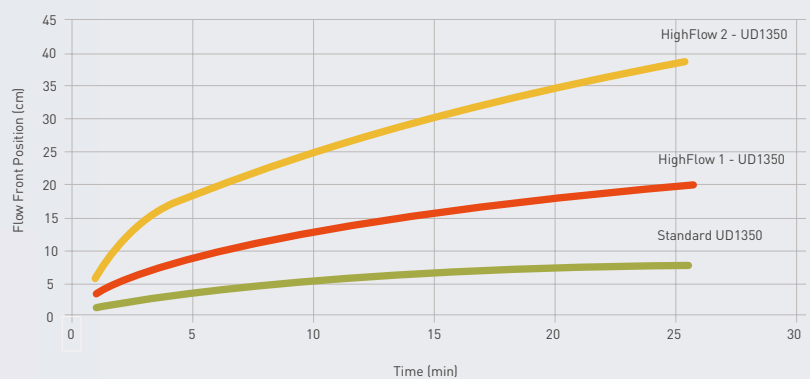
HIGHFLOW BY VITRULAN UD 1350 FABRIC (E-GLASS FIBER)

GRADE CODE	BASIS WEIGHT (g/m ²)	RESIN FLOW SPEED
HighFlow 1 UD1350 E-glass fiber	1400	Fast
HighFlow 2 UD1350 E-glass fiber	1400	Faster

HIGHFLOW BY VITRULAN UD 2000 FABRIC (HIGH MODULUS FIBER)

GRADE CODE	BASIS WEIGHT (g/m ²)	RESIN FLOW SPEED
HighFlow 1 UD2000 HM glass fiber	2065	Fast
HighFlow 2 UD2000 HM glass fiber	2065	Faster

UD REINFORCEMENT RESIN FLOW IN 90°-DIRECTION

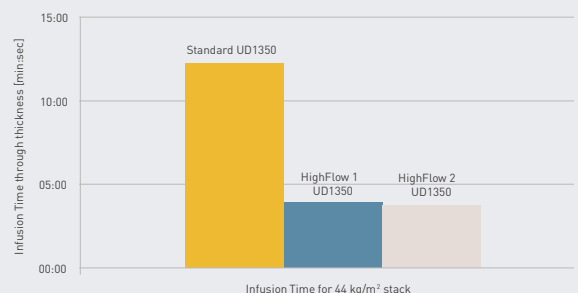


Resin Hexion: RIMR135i/RIMH137, Viscosity: 300 MPas, Test Set-up: 5 x UD 1350g/m²

PRODUCT	TIME IN MINUTES
Standard UD1350	12:20
HighFlow 1 UD1350	04:01
HighFlow 2 UD1350	03:55

Test Setup: 30 x UD1350 (44 kg/m²)
Resin: Hexion RIMR135i/RIMH137

Z-direction Flow through the thickness



BIAX FABRICS

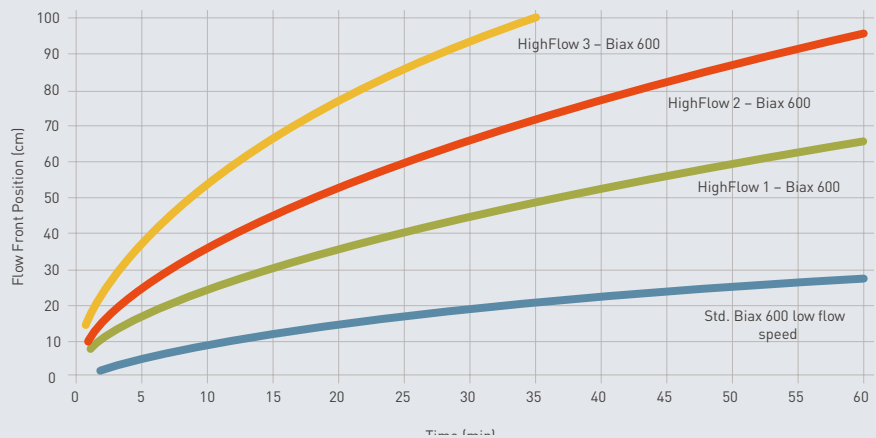
BENEFITS

- Delivers complete fabric wet out, minimizing air voids
- Maximises resin infusion, with process speeds up to 300% faster for the entire laminate construction
- Customises infusion speed, without any restrictions to product construction and weight
- Reduces total cost of ownership by up to 15%
- Biaxials available with E-glass fiber and Carbon fiber

HIGHFLOW BY VITRULAN BIAX 600 ±45° FABRICS (E-GLASS FIBER)

GRADE CODE	BASIS WEIGHT (g/m ²)	RESIN FLOW SPEED
HighFlow 1 Biax600 ±45°	600	Fast
HighFlow 2 Biax600 ±45°	600	Faster
HighFlow 3 Biax600 ±45°	600	Fastest

RESIN FLOW FRONT POSITION ESTIMATE FOR BIAX 600 45°/45°

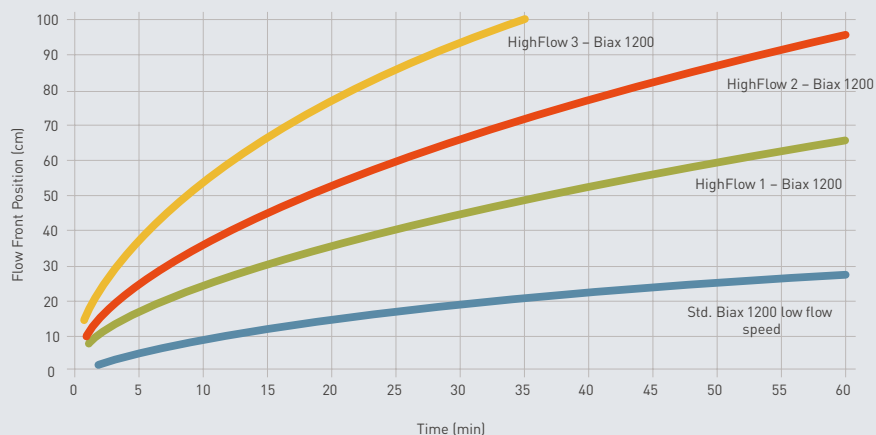


Resin Hexion: RIMR135i/RIMH137, Viscosity: 300 MPas, Test Set-up: 5 x Biax 600g/m²

HIGHFLOW BY VITRULAN BIAX 1200 ±45 FABRICS (E-GLASS FIBER)

GRADE CODE	BASIS WEIGHT (g/m ²)	RESIN FLOW SPEED
HighFlow 1 Biax1200 ±45°	1200	Fast
HighFlow 2 Biax1200 ±45°	1200	Faster
HighFlow 3 Biax1200 ±45°	600	Fastest

RESIN FLOW FRONT POSITION ESTIMATE FOR BIAX 1200 45°/45°



Resin Hexion: RIMR135i/RIMH137, Viscosity: 300 MPas, Test Set-up: 5 x Biax 1200 g/m²

The Vitrulan Group includes the three in Germany based companies Vitrulan Textile Glass, V4heat and Vitrulan Technical Textiles as well as Vitrulan Composites in Mikkeli / Finland.

Wall coverings manufactured from glass fabrics, modern infrared surface heating based on glass fabrics and technical textiles and composites made of glass, synthetic and carbon fibers are the core products of the Vitrulan Group.

The new subsidiary of the Vitrulan group, Vitrulan Composites Oy, is a manufacturer of fabrics made of glass, carbon, aramid and polyester fibers for the composite industry. The portfolio of the Mikkeli plant complements the technical textiles range of Vitrulan Technical Textiles GmbH. The application fields comprise transportation, marine, wind energy, anticorrosion as well as construction, insulation and sealing.

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