TYPE APPROVAL CERTIFICATE

Certificate No:
TAK00000HZ
Revision No:
1

This is to certify:

That the Carbon Fibre Products

with type designation(s)
HiMax® Biaxial;
LT (0°/90°) (100 - 1200 g/m²),
DB (+45°/-45°) (100 - 1200 g/m²),
DB (+30°/-30°) (100 - 1200 g/m²) and
DB (+60°/-60°) (100 - 1200 g/m²)
with or without F (20 – 50 g/m²) with or without DPA (3 - 8 g/m²)

Issued to
Hexcel Reinforcements UK Ltd
Narborough, Leicestershire, United Kingdom

is found to comply with
DNV class programme DNV-CP-0434 – Type approval – Uni- and multi-axial multi-ply fabrics made of carbon fibres
DNV rules for classification – High speed and light craft
DNV standard DNV-ST-0342 – Craft

Application :

For use in marine vessels according to stated Rules/Standards.

Product(s) approved by this certificate is/are accepted for installation on all vessels classed by DNV.

Issued at **Hamburg** on **2023-07-06**

This Certificate is valid until **2028-07-05**.
DNV local unit: **UK & Ireland CMC & VMC**

Approval Engineer: **Gisle Hersvik**

for **DNV**

Digitally Signed By: Wildhagen, Christian
Location: DNV Hamburg, Germany
Signing Date: 06.07.2023, on behalf of

Thorsten Lohmann
Head of Section

This Certificate is subject to terms and conditions overleaf. Any significant change in design or construction may render this Certificate invalid.
The validity date relates to the Type Approval Certificate and not to the approval of equipment/systems installed.

Product description

HiMax® Bi-axial Carbon Fibre Products of 0°/90°, +45°/-45°, +30°/-30° and of +60°/-60° orientations:

- Bi-directional stitched cross plied roving
- LT (0°/90°) (100 - 1200 g/m²) with or without F (20 – 50 g/m²) with or without DPA (3 - 8 g/m²)
  DB (+45°/-45°) (100 - 1200 g/m²) with or without F (20 – 50 g/m²) with or without DPA (3 - 8 g/m²)
  DB (+30°/-30°) (100 - 1200 g/m²) with or without F (20 – 50 g/m²) with or without DPA (3 - 8 g/m²)
  DB (+60°/-60°) (100 - 1200 g/m²) with or without F (20 – 50 g/m²) with or without DPA (3 - 8 g/m²)

Legends:
DB: Double Bias
L: Longitudinal
T: Transverse
F: Fleece (Micromesh/Veil/Nonwoven)
DPA: Dot Pattern Adhesive

The following indicative properties have been verified by Type Testing of laminates:

Property	**Test Method**	**FCIM105 / CGL3994** (45°) *	**C12K200** (+45° / -45°) **	**C12K300** (+45° / -45°) **		
Tensile Strength	ISO 527-4	1195	709 / 757	524 / 548	MPa	mean
Tensile Modulus	ISO 527-4	60.4	58.3 / 54.9	51.3 / 58.0	GPa	mean
Compressive Strength	ISO 14126	556	354 / 406	315 / 345	MPa	mean
Compressive Modulus	ISO 14126	57.6	59.0 / 71.2	73.3 / 52.9	GPa	mean
Flexural Strength	ISO 14125	885	695 / 752	623 / 549	MPa	mean
Flexural Modulus	ISO 14125	-	45.5 / 46.3	45.6 / 46.1	GPa	mean
Fibre content (by weight)	-	-	73.3	71.3	%	mean
Fibre volume fraction, FVF	ASTM D3171	52.6 – 55.2	-	-	%	mean
Resins		* CeTePox 3325 AM infusion resin ** Gurit's Ampreg 22 Epoxy Laminating System				
Curing Procedure for Type Testing		* Cure cycle: - ramp up at 1°C / min until 80°C - dwell at 80°C for 3 hrs - cool down (uncontrolled) to room temperature - with a min. 0.9 bar vacuum ** 24 hrs at ambient temperature, 16 hrs at 40°C				
Legend: mean = Mean of Type Test results						

Application/Limitation

Area of application will be evaluated during approval of classified objects.

The approval covers the weight ranges given above.

The fabric complies with the applicable requirements of DNV and is compatible to the laminating resin.

Any significant changes in design and / or quality of the material will render the approval invalid.

Type Approval documentation

1. Assessment Report from DNV Manchester of 2023-05-03, including attachment, ISO 9001 certificate, and Hexcel Report No. 6552, "Hexcel carbon NCF for DNV Type Approval" of 2022-12-12.
2. Application for Type Approval of 2022-01-07.
3. Hexcel Report No. 6306, "Mechanical evaluation of DPA technology on BB400 glass systems" of 2021-02-25.

4. Assessment Report from DNV GL Manchester of 2016-11-01.
5. Survey Report from DNV Sheffield of 2012-03-21.
6. Email from Formax UK Ltd. of 2012-03-24, including info from LR test report.
7. Email from Formax UK Ltd. of 2012-03-23, including Lloyds Register certificates and test results.
8. Email from Formax UK Ltd. of 2012-03-16, including Type Approval Documentation from Formax.
9. Emails from Formax UK Ltd. of 2012-03-06 and 2012-02-14 (including Lloyds Register certificates and test results) and 2012-02-08 (including Type Approval Application of 2012-02-08).

Tests carried out

Type Testing carried out according to **Type Approval documentation**.

Marking of product

Product shall be marked with *manufacturer's name*: **Hexcel Reinforcements UK Ltd.** and *type designation*.

The marking is to be carried out in such a way that it is visible, legible and indelible. The marking of product is to enable traceability to the DNV Type Approval Certificate.

Periodical assessment

The scope of the Periodical Assessment is to verify that the conditions stipulated for the Type Approval is complied with and that no alterations are made to the product design or choice of materials.

Periodical assessments (for Certificate Retention / Certificate Renewal) shall be performed according to DNV-CP-0338.

This certificate is only valid if required Periodical assessments are carried out with satisfactory results. To check the validity of this certificate, please look it up in https://approvalfinder.dnv.com

END OF CERTIFICATE