



TYPE APPROVAL

Certificate No.:
TA-DNV-CP-0084-09414-0

Issued:
2023-02-24

Valid until:
2027-12-13

Issued for:

Balsa

with type designation(s)

FLEXOKORE

As specified in Annex 1

Issued to:

Fadelma C. Ltda.

Km 9.5 Via Duran-Tambo Guayaquil, Ecuador

According to:

DNV-SE-0436:2021-09 Shop approval in renewable energy

and

DNV-CP-0084:2021-09 Type approval – Sandwich core materials

Applying:

DNV-SE-0441:2021-10 Type and component certification of wind turbines

Based on the documents listed in Annex 1.

This Type Approval supersedes the Type Approval TAK000012D

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

Hellerup, 2023-02-24
For DNV Renewables Certification

Hamburg, 2023-02-24
For DNV Renewables Certification

Bente Vestergaard
Service Line Leader

Bernhard Krüger
Project Manager

TYPE APPROVAL – ANNEX 1

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Product description and application

End grain balsa wood intended to be used for sandwich construction in composite manufacturing for mainly wind energy, and marine applications.

Approved variants

FLEXOKORE with a nominal density of 150 kg/m³.
Approved range: 130 – 160 kg/m³

Type Approval documentation

| | |
|-------------------------------|--|
| Technical data sheet(s) | FLEXOKORE end grain balsa, Fadelma C. LTDA |
| Safety data sheet(s) | Flexokore®, Fadelma C. LTDA, dated 2020-01-06 |
| Test report(s) | CTE Test Certificate, CTE-COC-6565 ISSUE 2, Composite Test & Evaluation Ltd., dated 2022-12-19 |
| Inspection report(s) | Workshop Inspection Report, WIR-09414-001 rev. 0, DNV, dated 2022-12-16 |
| Quality control documentation | Several certificate of analysis |

Material properties

| Property | Test standard | FLEXOKORE | Unit |
|-------------------------|---------------|-------------|-------------------|
| Nominal density | ISO 845:2009 | 150 | kg/m ³ |
| Compressive strength II | ISO 844:2014 | 15.8 (14.8) | MPa |
| Compressive modulus II | ISO 844:2014 | 3990 (3252) | MPa |
| Compressive strength # | ISO 844:2014 | 0.74 (0.59) | MPa |
| Compressive modulus # | ISO 844:2014 | 122 (50) | MPa |
| Shear strength | ISO 1922 | 2.63 (2.41) | MPa |
| Shear modulus | ISO 1922 | 165.3 (133) | MPa |

II Parallel to the grain
Perpendicular to the grain

All values are average values based on nominal density $\pm 5\%$ and verified by testing. The values within brackets are minimum values on the basis of average – 2 stdv.

Approved production sites

Fadelma C. Ltda.
Km 9.5 Via Duran-Tambo
Guayaquil, Ecuador
Last workshop inspection: 2022-12-16

Periodic assessment

2.5 years after this type approval is issued, the client shall inform DNV about any modifications in production. An intermediate inspection might be needed based on the implemented changes.