

FIBRE Max
World's strongest cable...

STEEL
BELONGS
TO THE PAST.



HISTORY OF SYNTHETIC FIBERS

SHORT INTRODUCTION ■



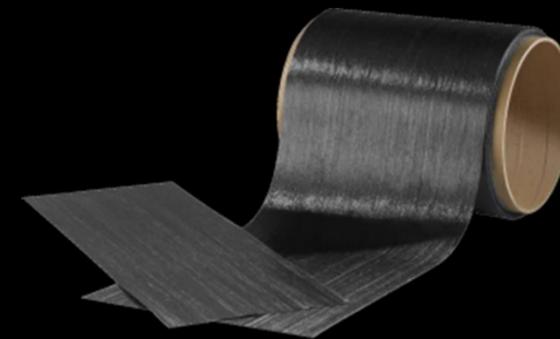
FIBREMAX

A SHORT OVERVIEW



History of Synthetics in Europe

- 1960–1980: Steel chains and wire ropes dominated offshore mooring
- 1980–2000: Polyester and HMPE introduced after testing programs
- European North Sea projects accelerated adoption
- Synthetic systems enabled deeper offshore developments
- Synthetic Materials used for Offshore Projects:
 - Aramid (Teijin Twaron, Dupond Kevlar), high temperature resistance, neglectable creep
 - HMPE (Toyobo Iznas, Dyneema DM20), low weight, low creep
 - Polyester, dominant fibre for Oil & Gas Deepwater mooring
 - Carbon, no creep, primarily used in yacht rigging and industrial applications



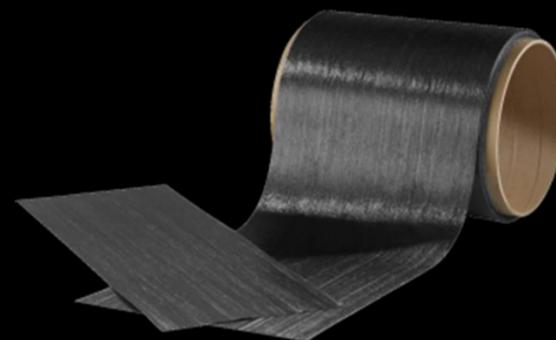
FIBREMAX

A SHORT OVERVIEW



History of Market Developments

- 1950–2026 : Polyester, main industry clothing industry, introduced as ‘easy ironing’
- 1980–2000: Aramid, HMPE, main Industry using and promoting synthetics: Offshore Oil & Gas
- European North Sea Oil & Gas projects accelerated adoption
- Netherlands, Norway, and UK companies led engineering development.
- Now the standard in floating production and offshore wind and crane industry, as critical structural components



FIBREMAX

A SHORT OVERVIEW



Advantages of Synthetic Fibers

Crane Industry

- Used on both On-and-Offshore Cranes (Crane Pendants and Lifting Systems)
- Up to 80% lighter than steel wire equivalents
- Improved safety during handling and installation
- No corrosion and reduced inspection downtime
- Unprecedented fatigue performance compared to steel



FIBREMAX

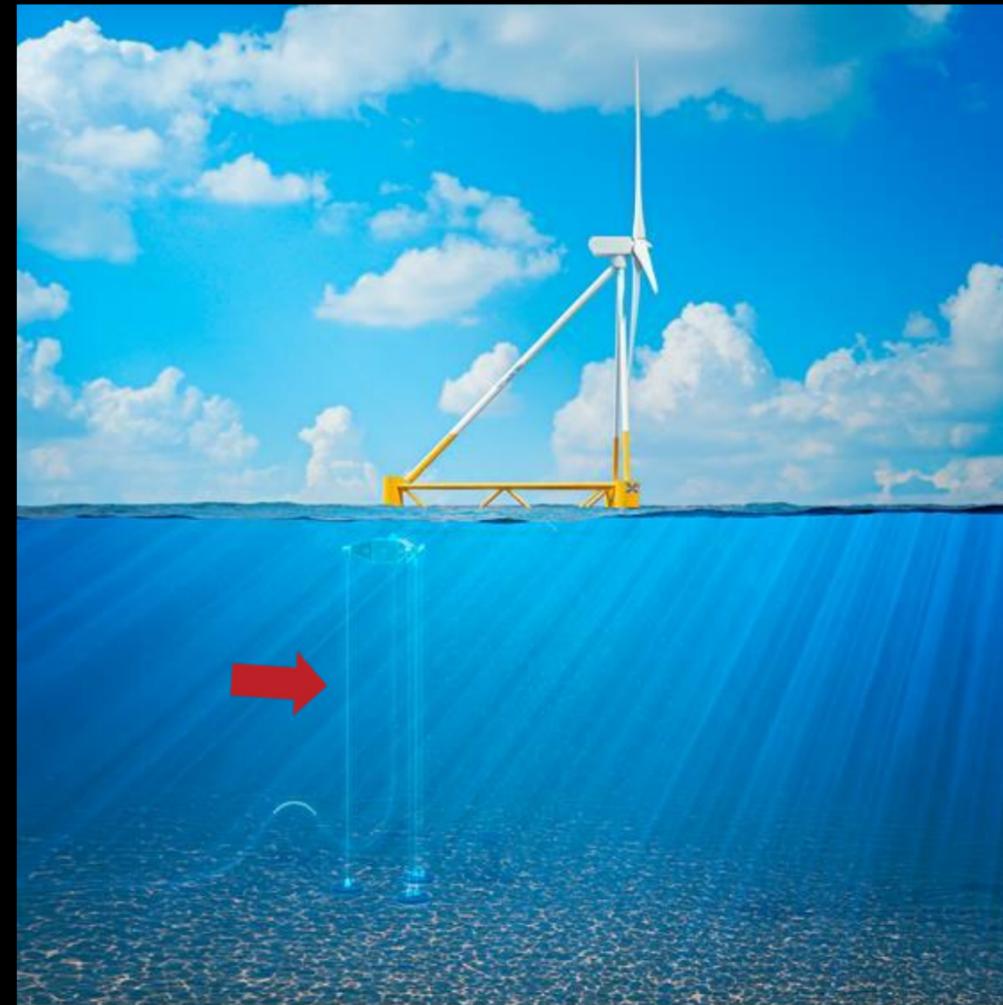
A SHORT OVERVIEW

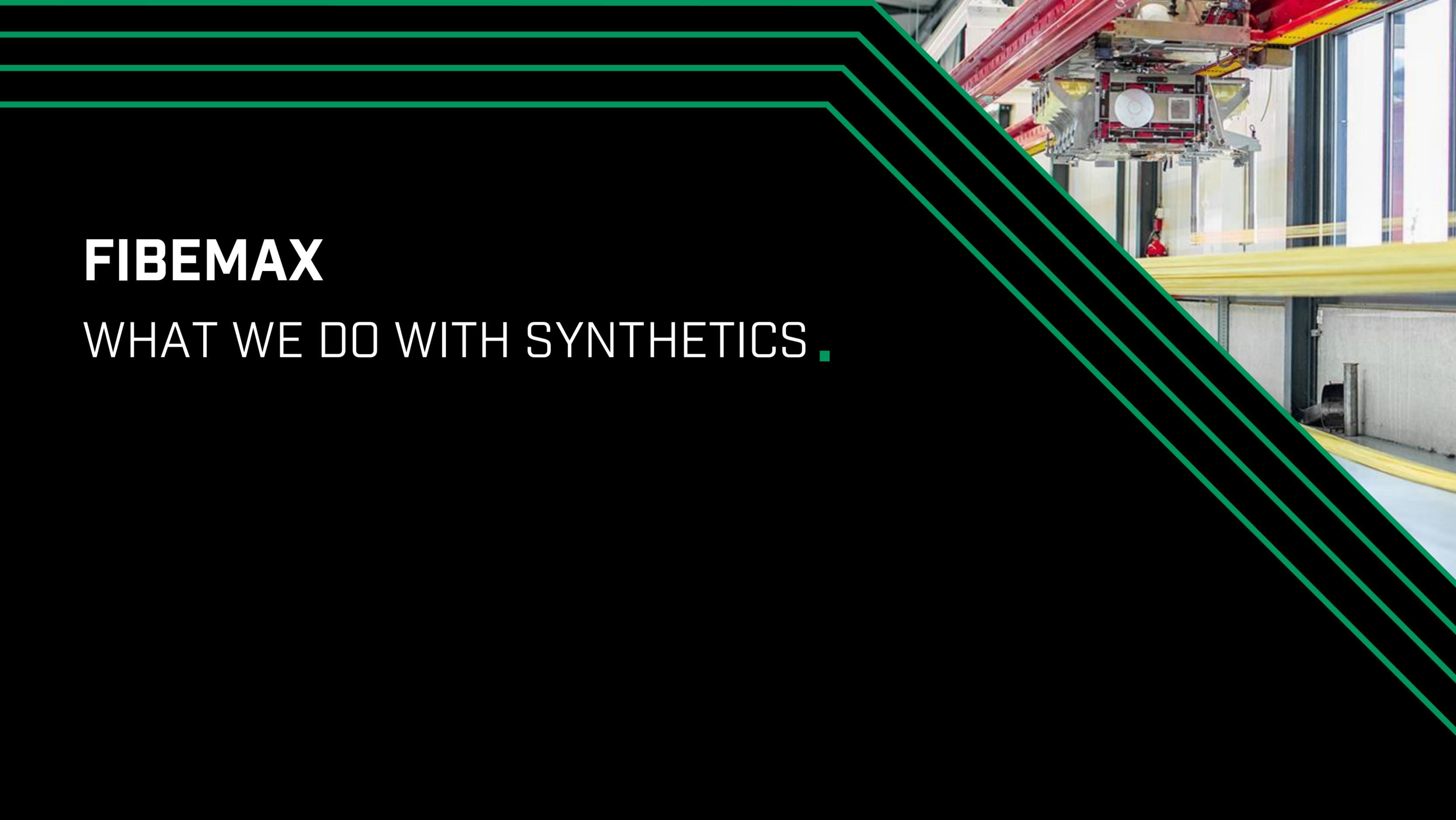


Advantages of Synthetic Fibers

Floating Offshore Wind

- Near-neutral buoyancy reduces vertical loads
- Higher strength-to-weight ratio than steel
- Up to 80% lighter than steel wire equivalents
- Reduced installation vessel size and fuel consumption.
- Unprecedented fatigue performance compared to steel
- Critical design options for stretch required moorings





FIBEMAX

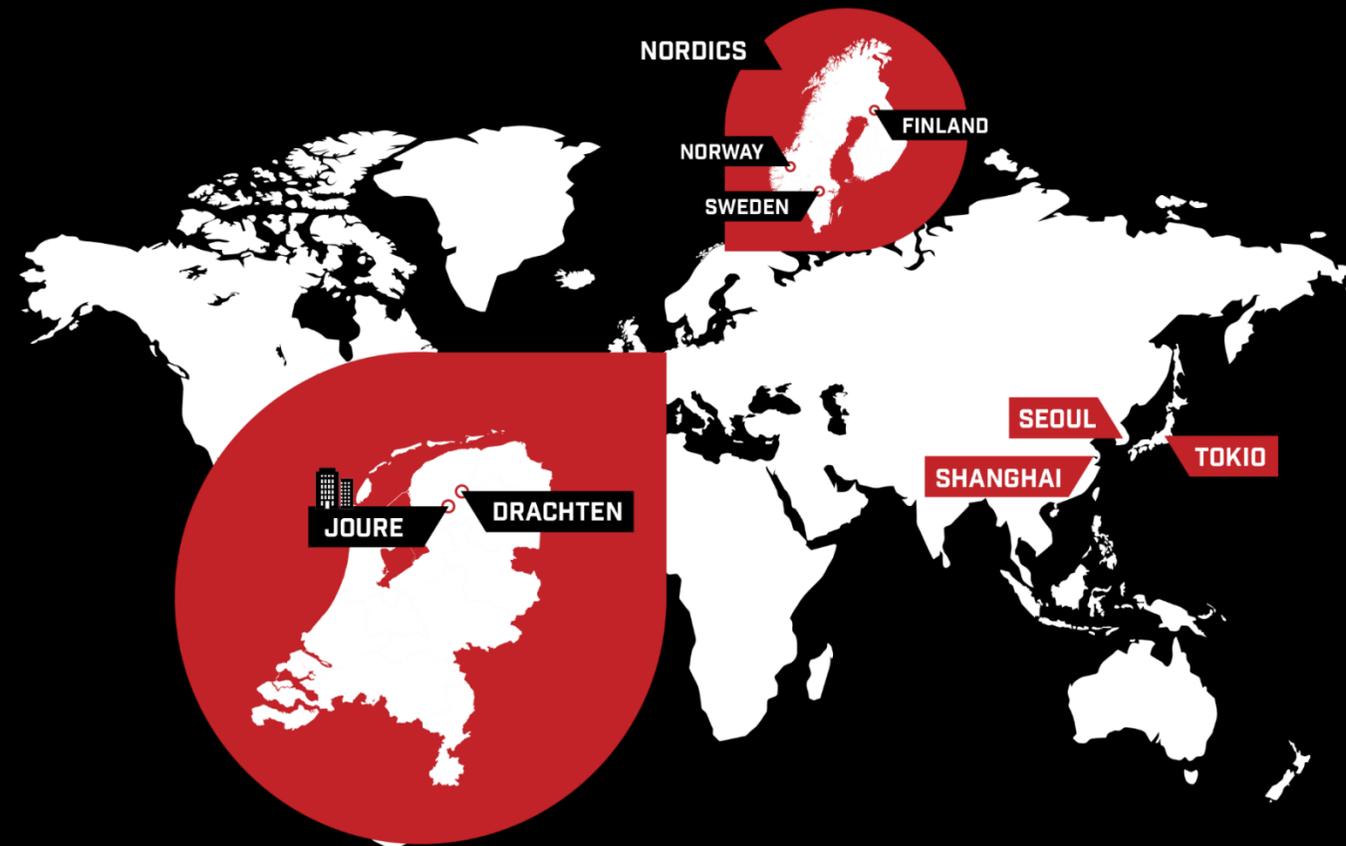
WHAT WE DO WITH SYNTHETICS .

FIBREMAX

A SHORT OVERVIEW

📍 HQ in Joure, the Netherlands

- Cable innovator since 2004, SmartRigging
 - Since 2009 FibreMax
- 15.000+ cables made
- Always mission critical applications
- 100% solar power driven
 - CO2 negative production process
- Zero LTI's since 2009

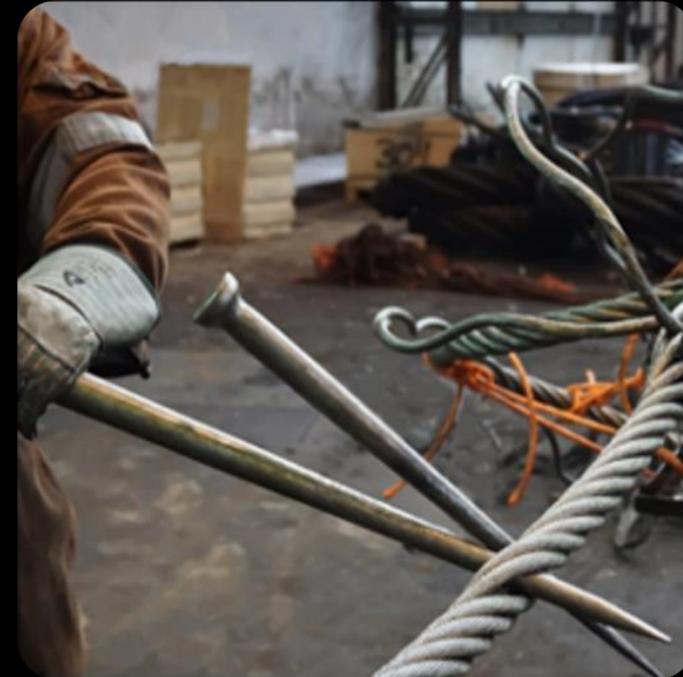


FIBREMAX

THE INNOVATION CHALLENGE

 How to solve:

- Corrosion
- Maintenance
- Metal fatigue
- Sudden failure
- Fibre to fibre abrasion
- Man-made end terminations





FIBREMax
World's strongest cable...

Automated Production

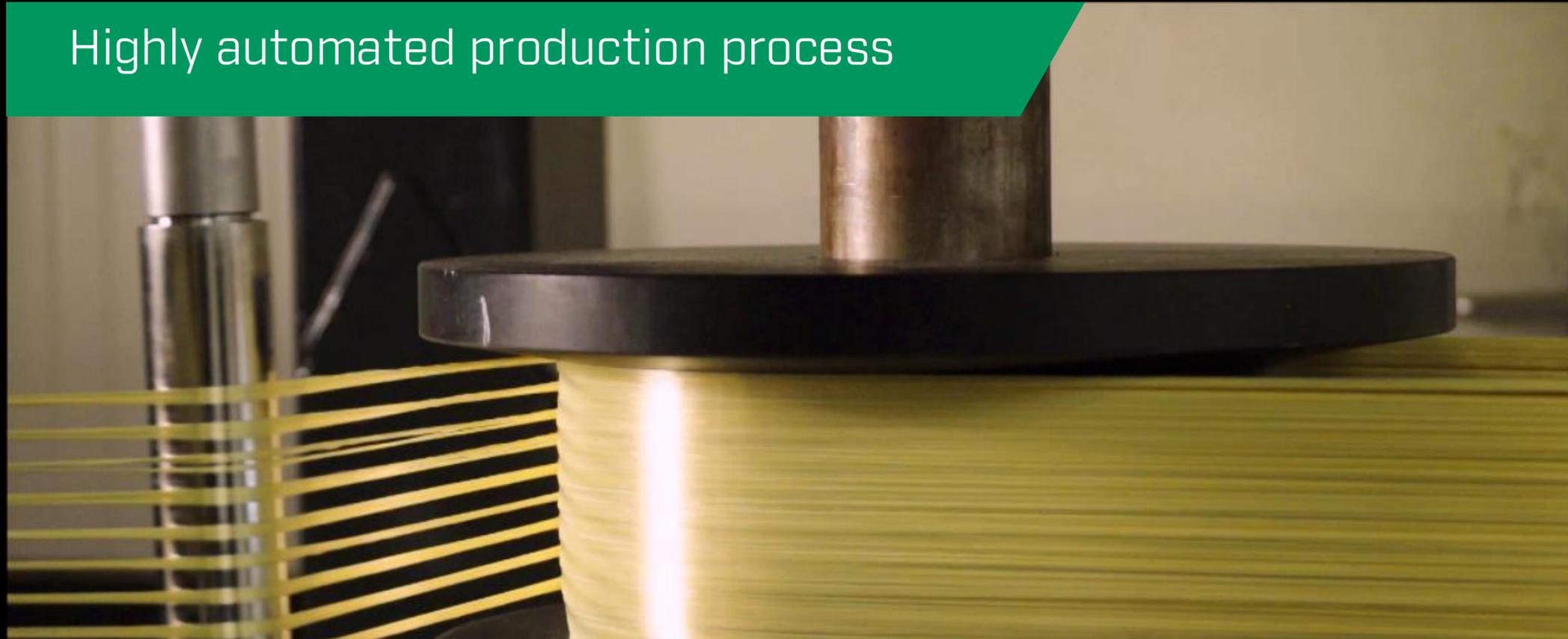
Innovation! Automation! Scalable!



ENDLESS WOUND PARALLEL FIBRES

UNIQUE WITH OVER 160 WORLD PATENTS

Highly automated production process



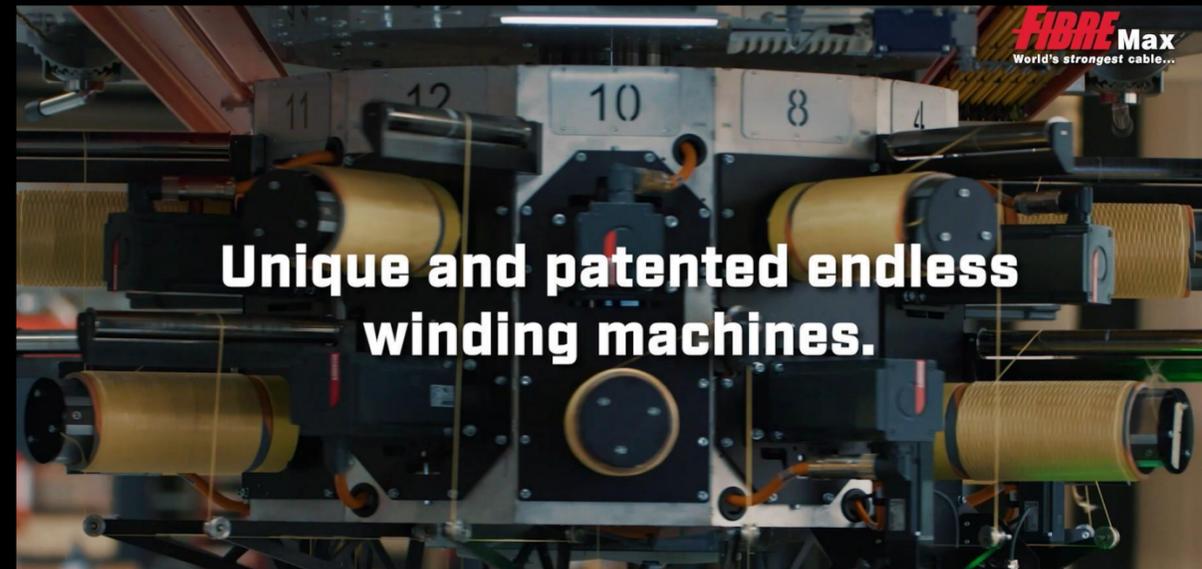
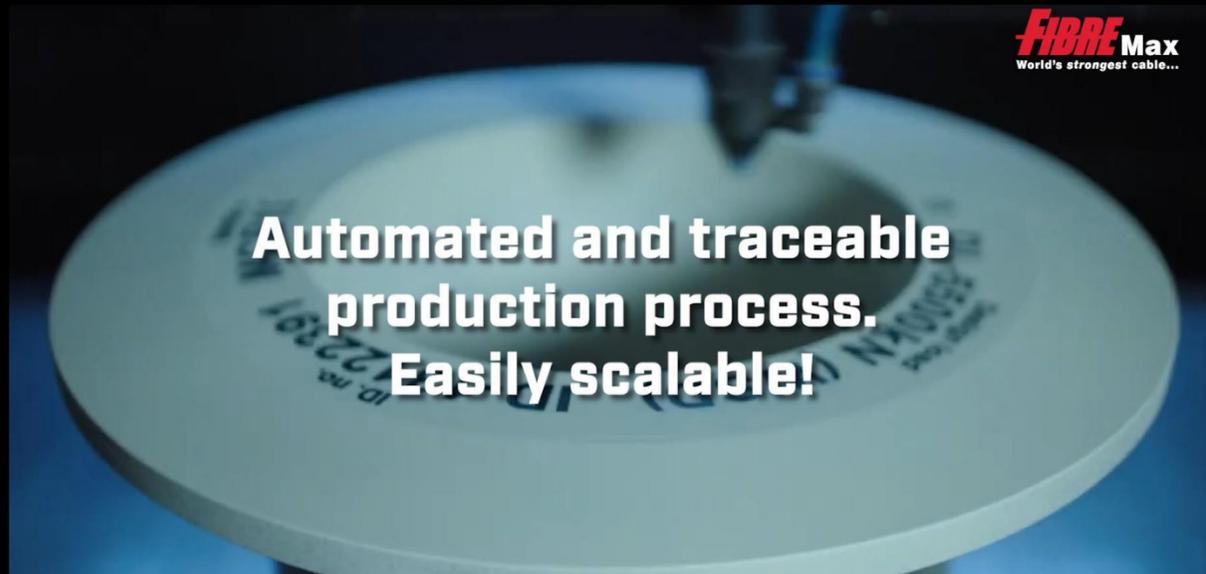
- Integrated end terminations
- Exact lengths
- Production with any fibre

- No Fibre-to-Fibre abrasion
- No bedding in
- No splicing
- No pre stretching

- Scalable
- No specialized workforce
- Availability

Automated Production

Innovation! Automation! Scalable!



FIBREMAX MARKETS .



ON-AND-OFFSHORE CRANES

RECOGNIZED GLOBAL LEADER & INNOVATOR IN SYNTHETIC CRANE PENDANTS

Crane pendants



LIEBHERR



SENNEBOGEN



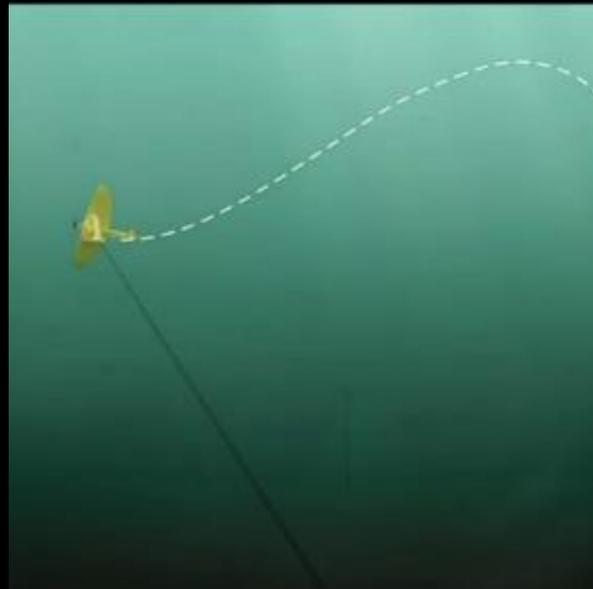
LIEBHERR



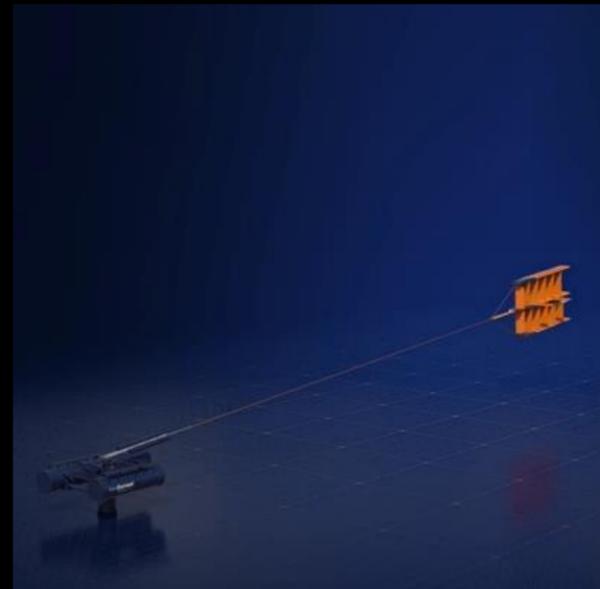
Huisman

OTHER MARKETS

WAVE & TIDAL, FLOATING SOLAR, AQUA CULTURE, STRUCTURAL



MAIN TETHER



MAIN TETHER



VERTICAL AND
DIAGONAL LASHING



STAY CABLES



STAY CABLES

OFFSHORE WIND
STIFFNESS DRIVEN MOORING SOLUTIONS
FOR ALL DESIGNS ■



FULLY RESTRAINED PLATFORM (FRP)

FOR XXL MONOPILES FROM 60 TO 100-METER WATER DEPTHS

Made with Aramid

- Linear tension application
- Designed on stiffness
- Neglectable creep
- No need for tensioners
- No corrosion
- Lightweight
- Circular fibres



50m – 100m

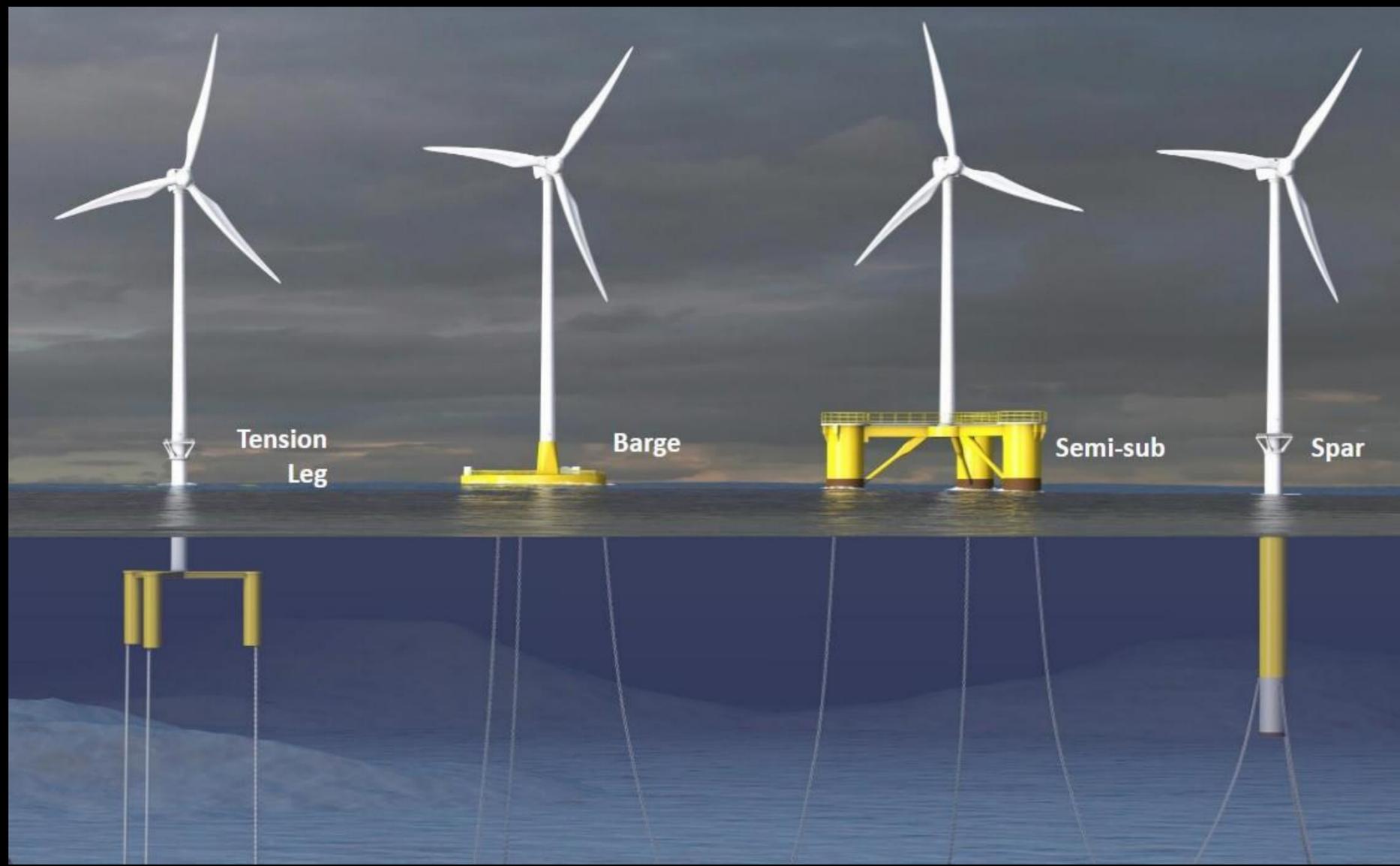
FRP Monopile

FLOATING OFFSHORE WIND

Various technologies



Floating technologies



Source: UMaine

TENSION LEG PLATFORM (TLP)

VERY SPECIFIC REQUIREMENTS

The ultimate tendon

- Designed on stiffness (EA) or Strength (MBL)
- Exact lengths
- No need for tensioners
- No corrosion
- Lightweight
- Circular fibres
- Scalable & available



Courtesy Acteon



SEMI-SUB, BARGE & SPAR

THE SCALABLE ALTERNATIVE FOR POLYESTER ROPE

PolyMax, polyester made *easy*

PolyMax
Polyester made *easy*...

- Up to 40% less shock loads
- Linear behavior
- No splicing, no pre stretching
- Integrated end terminations
- Easy engineering
- Designed on Strength (MBL) or Stiffness (EA)
- Scalable & available
- Local content opportunity



Courtesy Acteon



MONOBASE WIND





FIBREMAX - FIBRETECH
EXSTENSIVE & RELEVANT TESTING.

FibreTech

EXTENSIVE & RELEVANT TESTING!

FibreTech, *the knowledge center*

FIBRETech
The knowledge center...

FibreMax is the only company to offer dynamic testing through tensile test machines, with generated data made available via the self-developed dynamic line configurator



The ability to design and test for this performance & dynamic behavior is of critical importance to Floating Wind-cases. Moreover; it allows FibreMax to work with a broader range of fibre suppliers and variability in supply, obtain relevant certifications and guarantee specifications



FIBREMAX
IT SOLUTIONS ■

IT DEVELOPMENT & INNOVATION

ORCAFLEX LINETYPE GENERATOR

Easy engineering



Fibre Calculation Tool
OrcaFlex Linetype Generator

Version: 2.0
Last updated date: 12-12-2023

Tendon / Tether

Determine input: Breakload [kN]

Breakload: 25000 [kN]

Dynamic stiffness (EA):
[MN]

Dynamic stiffness per length:
[kN/m]

Length: 250 [m]

Fibre choice: Twaron 3200 Ultra High Modulus (E_t 138)

Parameters

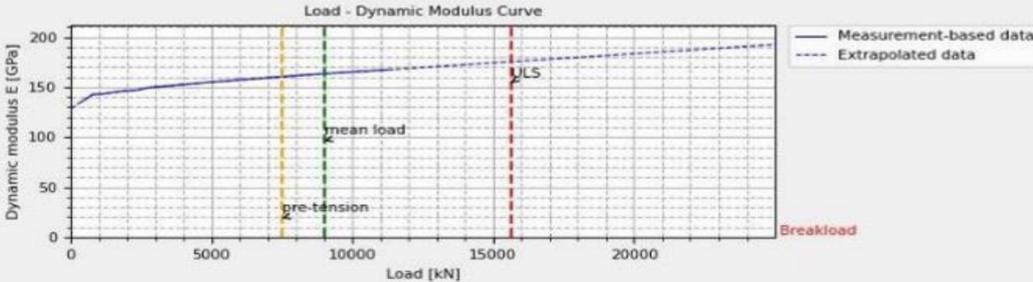
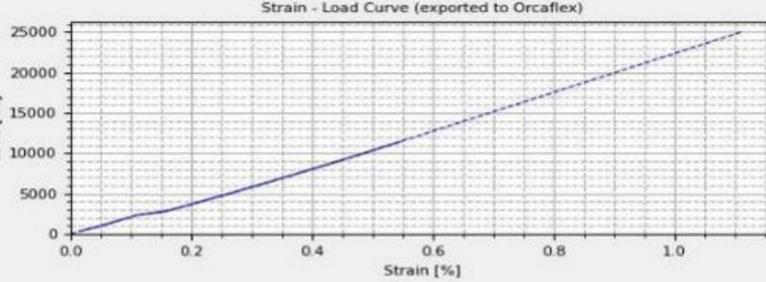
Breakload:	25000.00	[kN]
EA static:	2248.82	[MN]
Diameter gross:	178.66	[mm] Excl: cover and fitting
Weight per length in air:	23.63	[kg/m] Excl: cover and fitting
Weight per length in water:	6.94	[kg/m] Excl: cover and fitting

Calculation

Tendon parameters calculated with this (Fibremax proprietary) tool should be considered as a close approximation suitable for feasibility studies. For detailed Engineering and/or classification purposes Fibremax should be contacted for the provision of product specific supplier data.

Plot

Pre-tension [kN] Mean load [kN] ULS [kN]

Developed by: 

■ Beta 2.4 version released June 2024



FIBREMAX Certification.

Certification – DNV, ABS, Class NK

Making progress where it matters

Market requirement



APPROVAL OF MANUFACTURER CERTIFICATE

Certificate No: **AMPM000003R**
Revision No: **2**

This is to certify:
That **FibreMax B.V.**
Joure, Friesland, Netherlands

is an approved manufacturer of
Offshore fibre ropes

in accordance with
DNV GL class programme DNVGL-CP-0173 – Manufacture of offshore fibre ropes



STATEMENT OF FEASIBILITY

No. 2022-3237 Valid until: N/A

This is to state that DNV has evaluated the feasibility of qualifying the technology designated

E.R.I.T. structural cables

with basis in DNV-SE-0160 *Technology qualification management and verification I/1*.

At the time of this statement and with basis in received information /2/3/, DNV considers technology qualification to be feasible as set out below. The resulting qualified performance for a given cable dimension will depend on the outcome.

Owner: FibreMax BV

Objective of this document: To affirm that DNV considers technology qualification to be feasible on the basis of received information /2/3/, and provided that all critical parameters are identified and managed in the continued technology qualification. DNV considers that a comprehensive qualification effort will be required.

Application: TLP mooring

Description: Parallel-wound synthetic cable based on Twaron 2200 fibres where terminations are infused with epoxy resin.



Approval No. WRP1
Certificate No. TA24739E

APPROVAL IN PRINCIPLE

SYNTHETIC FIBRE ROPE FOR FOWT

This is to certify that Approval in Principle for design is granted to
FibreMax B.V.

Bokkewiel 6, 8502 TX Joure, The Netherlands

The design of the product has been examined as the mooring equipment for floating offshore wind turbine (FOWT) by the NIPPON KAIJI KYOKAI in accordance with NKRE-GL-FOWT01: Guidelines for Floating Offshore Wind Turbines, under the following conditions.

Kind of Product : Synthetic Fiber Ropes for floating type offshore wind turbine
Intended for : FMO-23007

Particulars

Trade Name : Endress Wound TENDONS
Kind of filament : Aramid (Twaron®2200)
Configuration : Endress wound (parallel)

Certification – DNV, ABS, Class NK

Making progress where it matters

JIP Stiffness driven mooring designs



The screenshot shows a news article from ABS & Affiliated Companies. The article title is "ABS and FibreMax to Explore Floating Offshore Wind Mooring Technologies". It includes social media sharing icons for X, Facebook, LinkedIn, and Pinterest. The date is "THU, JUN 27, 2024 15:15 CET". There is a "Report this content" link. The main image shows several large, cylindrical mooring tendons in a factory setting. The text of the article discusses a pioneering agreement between ABS and FibreMax to collaborate on stiffness-driven mooring tendons for the offshore wind market. It details the collaboration's focus on testing and analysis, and includes quotes from Robert Langford, ABS Vice President, and Sander van Helvoort, Director Renewable Energy at FibreMax. The article also mentions ABS's certification of various offshore wind projects.

ABS
& AFFILIATED COMPANIES

news.otsion.com / American Bureau of Shipping / ABS and FibreMax to Explore Floating ...

ABS and FibreMax to Explore Floating Offshore Wind Mooring Technologies

THU, JUN 27, 2024 15:15 CET

Report this content

(HOUSTON) ABS and FibreMax signed a pioneering agreement to collaborate on stiffness-driven mooring tendons for the offshore wind market.

The collaboration, which is principally focused on floating offshore wind assets, will see ABS provide qualification of FibreMax's fiber and small rope testing. ABS will evaluate test methods for accuracy in predicting the parameters needed to perform representative analysis, focusing on stiffness. FibreMax will provide expertise on stiffness, based on its patented Parallel Wound Technology (PWT).

"ABS' extensive experience in verification across the marine and offshore industries make us the ideal partner for this project. We are committed to safety excellence and to advancing safety standards across the offshore wind industry for new technologies," said Robert Langford, ABS Vice President, Global Offshore Wind.

"We are excited to work together with ABS, given their impressive track record in floating offshore wind. Together with ABS, we will work to include operational parameters for stiffness-driven designs with the objective to jointly develop relevant parameters for these emerging designs and market," said Sander van Helvoort, Director Renewable Energy at FibreMax.

ABS certified the first U.S. offshore wind project in Orsted's Block Island. Worldwide, ABS certified the first semisubmersible floating offshore wind turbine, WindFloat I; classed the world's largest floating wind turbine at the time of installation with Windfloat Atlantic developed and operated by Ocean Winds; classed Kincardine, the world's largest grid-connected floating offshore wind farm; and performed statutory reviews on behalf of International Registries Inc. (IRI) for Kincardine.

For more information on ABS Global Offshore Wind services, click here. For more information on FibreMax, click here.

Photo Caption: Tendon mooring lines that support Floating Offshore Wind – Courtesy of FibreMax

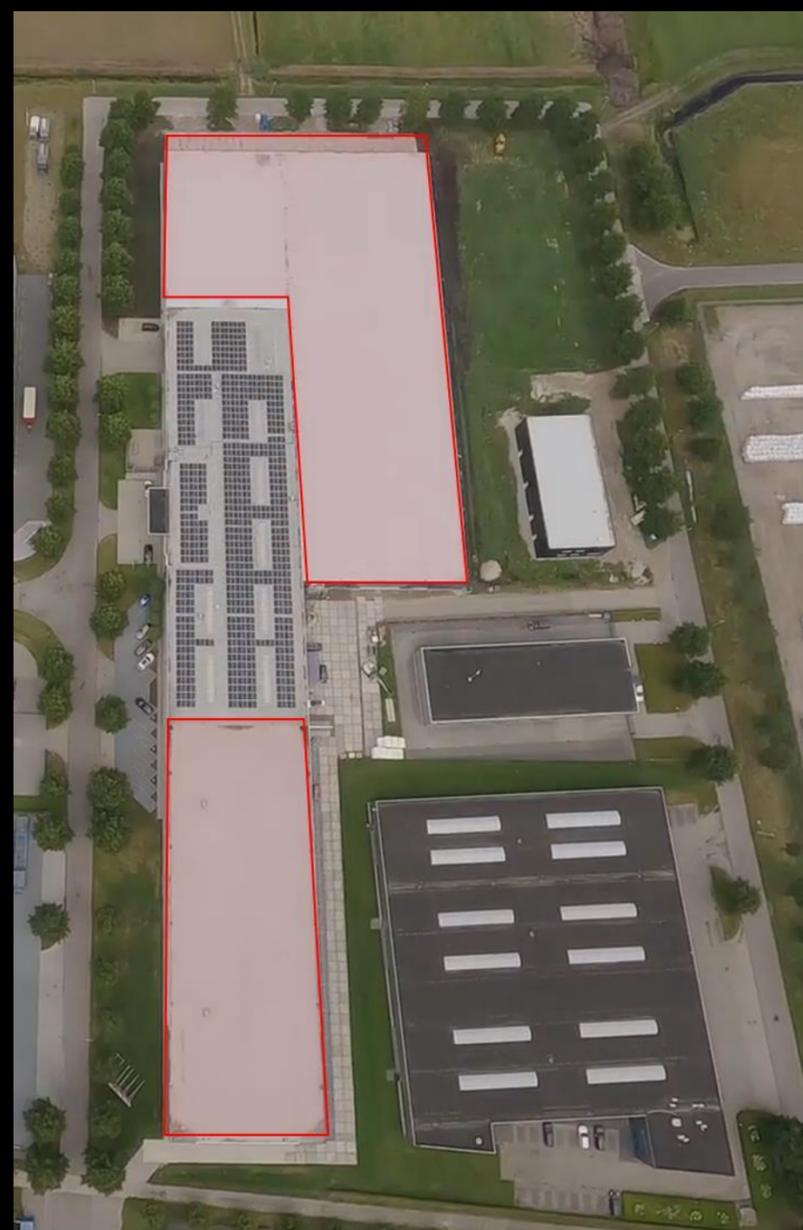
Tags:
ABS, offshore wind

FIBREMAX
READY FOR THE FUTURE ■



FACILITY JOURE, THE NETHERLANDS (HQ)

EXPANDED TO (12.000M²)



**INCREASED
CAPACITY**

EXPANSION AND SECOND FACILITY

SECOND FACILITY IS DEDICATED FOR FOW 22.500 M2

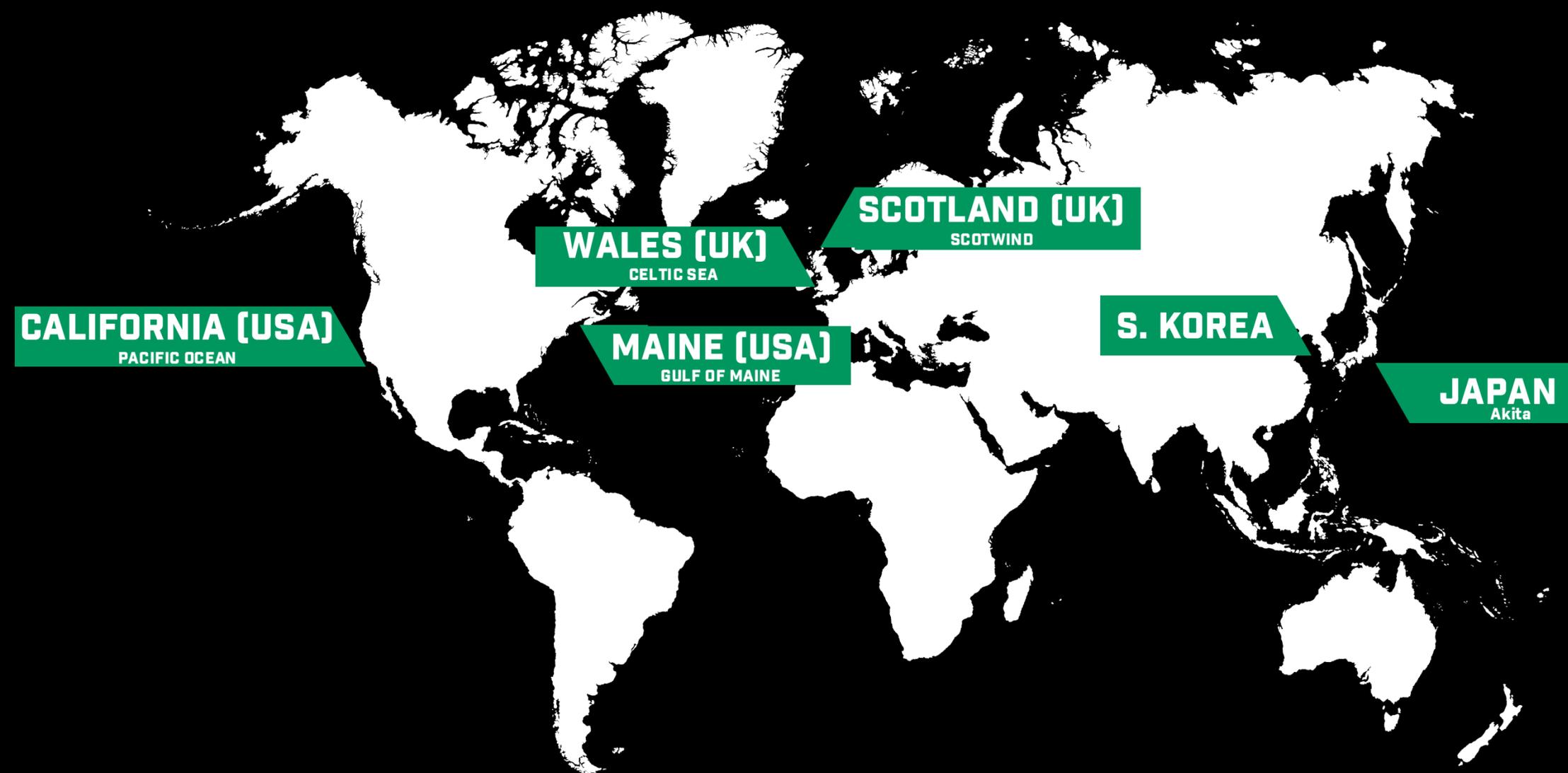


**READY TO
DELIVER**



LOCALISATION

REQUIREMENTS ALMOST EVERYWHERE IN THE WORLD



FIBRE Max
World's strongest cable...

**THANK YOU
FOR YOUR
ATTENTION!**





FIBREMAX - FIBRETECH

FATIGUE TESTING EXAMPLE



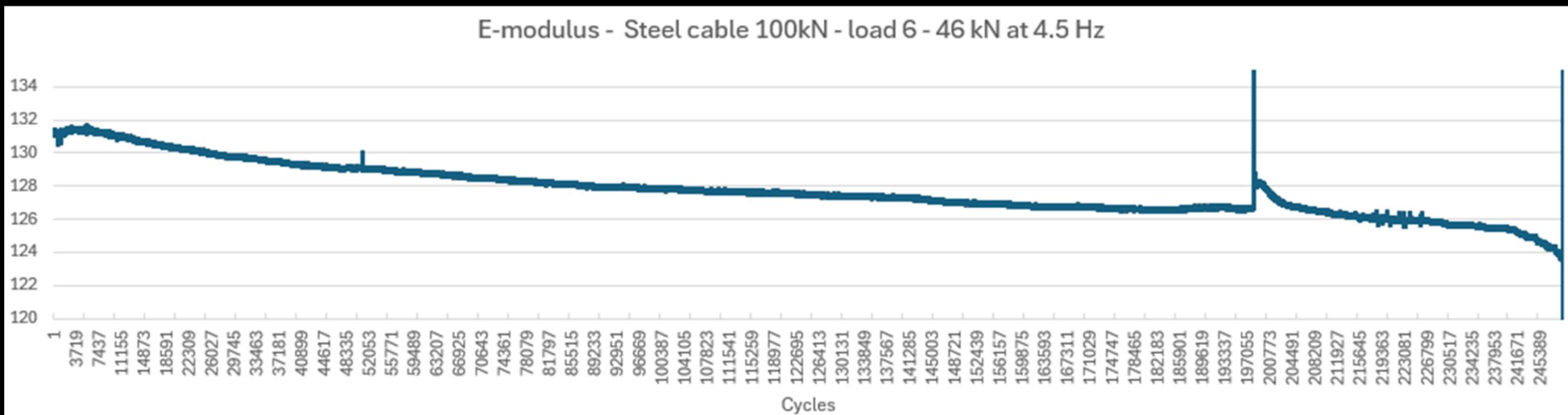
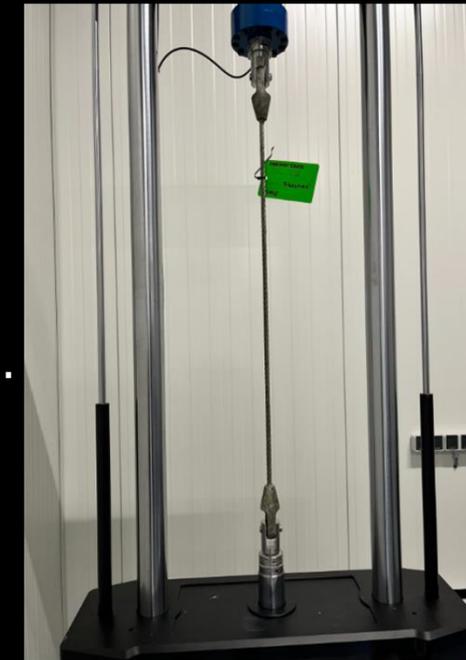
FibreTech

Fatigue Testing

Steel Wire – 100 kN



Test performed from 6% to 46% load of MBL at 4.5 Hz.
Result: sample failed at appr. 250.000 load cycles



FibreTech

Fatigue Testing

FibreMax Aramid Tendon 100 kN

FIBRETech
The knowledge center...

Test performed from 6% to 46% load of MBL at 4.5 Hz.
Result: test stopped at appr. 74.500.000 (!!!) load cycles
Due to no change in condition (already 300 times better compared to steel)

