

# EXPO-NET

## Plastic net specialists

Plastic net specialist **EXPO-NET** gets technical to improve FRP resin infusion control and sustainability

**I**nternational plastic net specialist EXPO-NET® Danmark A/S has been developing and manufacturing thermoplastic netting and flow mesh products since 1959. The extensive product range is manufactured from 100% recyclable polyethylene (PE) and polypropylene (PP) polymer grades in mesh sizes from 1mm<sup>2</sup> - 30mm<sup>2</sup>. Nets and meshes are extruded in flat and tubular forms, custom supplied on a roll or cut to size as required.

EXPO-NET's head office, extrusion lines, research, engineering and main warehousing facilities are located in Hjørring, Denmark. The 12.000 sq. m site and operations are ISO 9001:2015 and 14001:2015 certified. Production engineering on site includes a

'state-of-the-art' workshop for both in-house maintenance and building innovative new plastic net production equipment.

The range of resin flow mesh products developed by EXPO-NET are used around the world by composites manufacturers as a key vacuum infusion processing aid to reliably and consistently mould large, complex, fibre reinforced plastic (FRP) components; some producers can use three or four different flow mesh grades for specific parts of the mould to increase productivity and product quality. The composites customer base includes major producers in the wind energy, automotive, aerospace, marine and construction industries.

EXPO-NET plastic netting is also used in a variety of applications, such as protection and filtering, in other industrial, commercial and consumer market sectors including: telecoms; biogas; building and construction; gas/liquid filters; HVAC systems; wastewater treatment; aquaculture fish farming; food packaging.



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1. EXPO-NET 12.000 sq. m site, Hjørring, Denmark.

2&3. 'State-of-the-art' PE and PP netting extrusion lines and production workshop facilities are installed in EXPO-NET's in Hjørring, Denmark.



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From the start, the company has always been innovative. EXPO-NET was one of the first net extruders back in the 1990s to develop and supply pioneering wind energy OEMs with problem solving flow mesh products to improve vacuum processing and 'right first time' production of FRP rotor blades and nacelles.

The team of research and product development engineers working in EXPO-NET has gained a deep technical understanding and knowledge of polymers, plastic net production and composites, including the reinforcements, sandwich laminate designs, resins and infusion processes used to mould large composite parts.

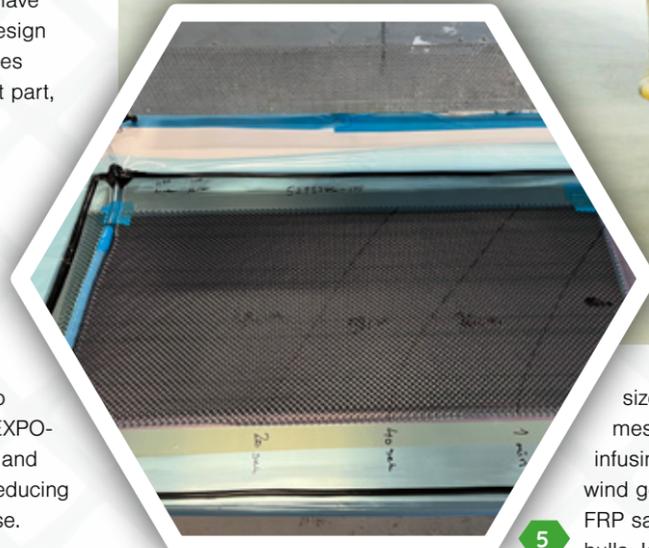
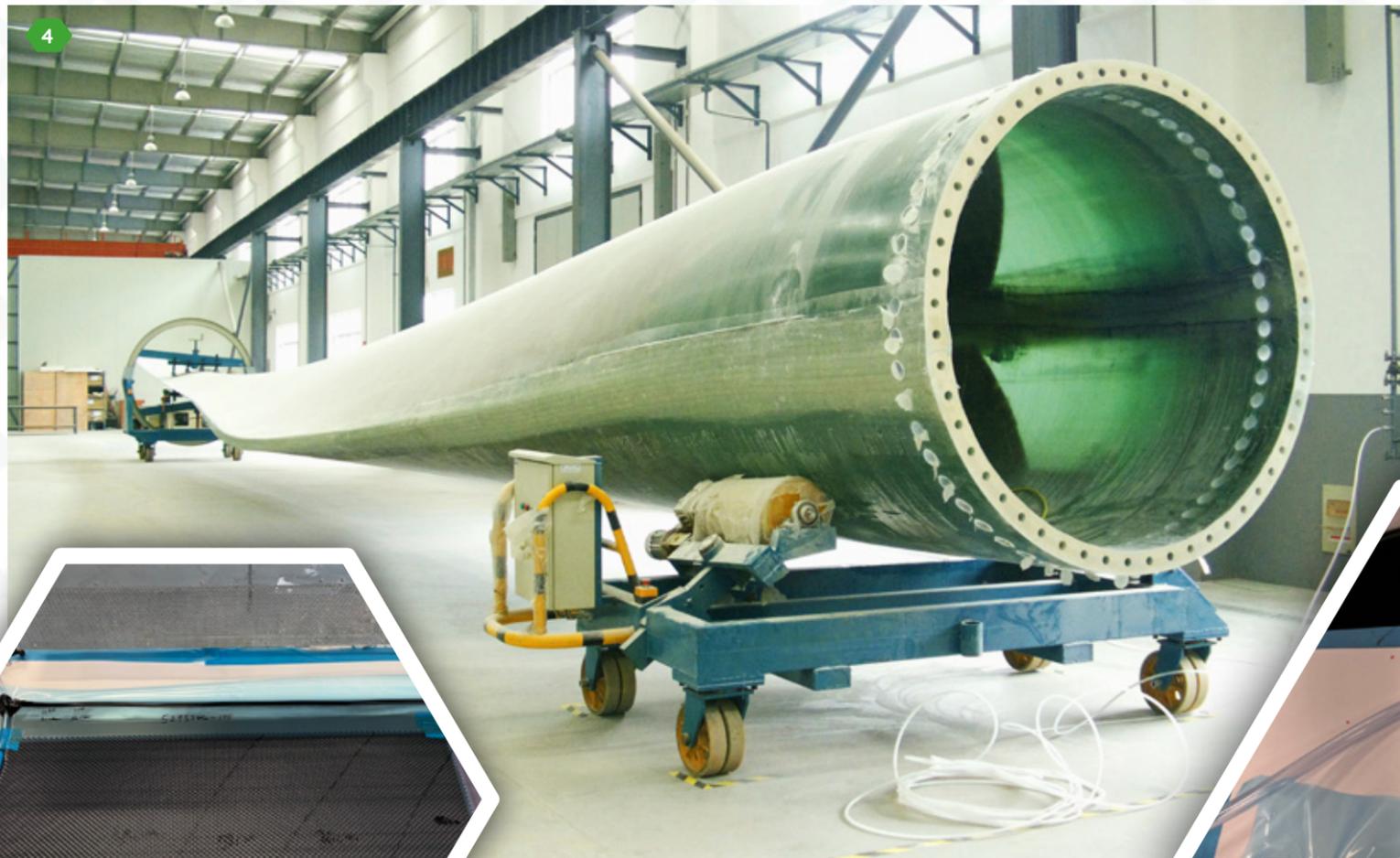
EXPO-NET's products have proved vital to ensure consistent processing and mould part quality. Customer trials have demonstrated that using the right design and combination of resin flow meshes can help to avoid producing a reject part, particularly due to premature resin hardening and trapped air voids.

Privately owned, the EXPO-NET management team remains focused on being innovative and finding ways to keeping adding value to its customers. Ongoing strategic investments are made in R&D and technical support, maintaining and upgrading production facilities and to improve sustainability. Since 2009, EXPO-NET has been proactive in recycling and operating as a 'green' business by reducing CO<sub>2</sub> emissions, waste and energy use.

EXPO-NET will be exhibiting at JEC World 2023 in Paris, where it will be showcasing its latest technical developments.

**New technical developments**

During 2022, extensive research and technical development resources focused on two key areas. Firstly, carrying out flow rate tests on EXPO-NET resin flow mesh grades to obtain comparative data to help customers improve vacuum infusion resin flow control and predictability. Secondly, developing 'bio-attributed' plastic netting products to be able to offer customers more sustainable alternative products.



**1 Comparative vacuum infusion resin flow mesh data**

The two key functions of plastic resin flow mesh products are to ensure the rapid spread of a vacuum infused resin throughout the composite component being moulded, and to also enable the efficient removal of air in the FRP laminate system to avoid voids. To achieve these two key processing quality criteria, one or more resin flow mesh products need to be included a mould dry layup system.

Controlled vacuum bagging infusion tests were set up using different mesh

sized flat, drapable, EXPO-NET flow mesh grades typically recommended for infusing large composite parts, such as wind generator nacelles, rotor blades and FRP sandwich laminate boat decks and hulls. Identical vacuum bagging tests were conducted to obtain comparative resin flow rate data that can help processors to better understand the rheological impact and benefits of specific grades of EXPO-NET resin flow meshes during vacuum infusion.

The flow tests were carried out using the facilities at the Tech College in Aalborg, Denmark, which specializes in training courses on composite materials and processing; leading OEM wind blade producers send new production staff to this college to be trained. The testing was done by Mr. Mark Holmgaard Christensen, one of EXPO-NET's composite specialist

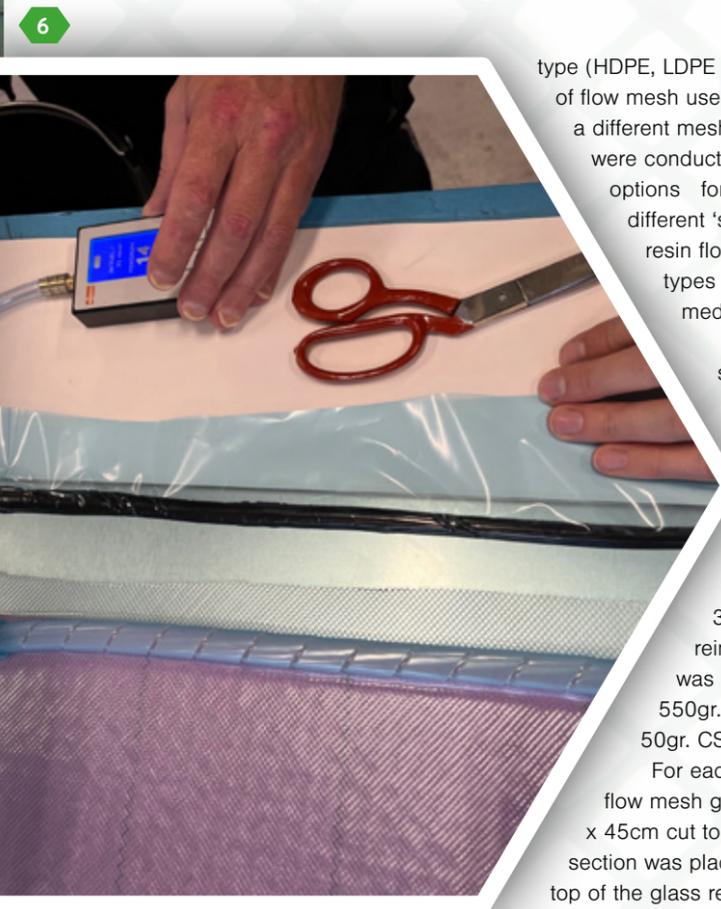
**4:** A new wind blade development project typically involves the EXPO-NET team in several trials, modifying and supplying different resin flow mesh products and specifications.

**5:** Each EXPO-NET resin flow mesh grade tested was 85cm x 45cm, placed on top of the three biaxial/CSM glass reinforcement layers.

**6:** Monitoring the vacuum pressure fall after 10 mins to ensure consistent test conditions.

development engineers and factory manager, who previously worked for Bach Composite Industry A/S; he is also one of the Tech College composite training course examiners.

To ensure that direct comparisons



could be made from the resin flow rate test data, an identical test plate size, glass reinforcement materials, epoxy resin system, ambient temperature and vacuum bagging conditions were used. The only variable in each test was the

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Mark Holmgaard Christensen

type (HDPE, LDPE or PP) and grade of flow mesh used, which each had a different mesh size. Six tests were conducted, with two grade options for each of the three different 'speed' EXPO-NET resin flow mesh product types tested - quick, medium and slow.

“We used a standard mould test plate 90cm x 50cm, laying up each of the six test plates with three layers of glass reinforcements 38cm x 90cm: each reinforcement layer was a combination of a 550gr. biaxial fabric and a 50gr. CSM.

For each EXPO-NET resin flow mesh grade test, an 85cm x 45cm cut to size flow mesh section was placed immediately on top of the glass reinforcement layers, then adding the release film, vacuum bag and resin flow pipes. The same epoxy resin and hardener system with a viscosity 1200-1400 cPs (@ 25 OC) was used for each test. All infused parts were tight, with no air trapped, and no pressure fall after 10 mins was recorded.” explained Christensen.

Vacuum Infusion Test Data for EXPO-NET Resin Flow Mesh Grades 1-6

Infusion time (seconds)	'Quick' flow mesh - Grade 1 (Grey line)	'Quick' flow mesh - Grade 2 (Green line)	'Medium' flow mesh - Grade 3 (Dk. Blue line)	'Medium' flow mesh - Grade 4 (Lt. Blue line)	'Slow' flow mesh - Grade 5 (Orange line)	'Slow' flow mesh - Grade 6 (Yellow line)
	Distance (cm)					
20	39	51.5	31	30	21	18
40	58	62	44	40.5	28	26
60	76	79	52	49	34	31
90			64.5	61.5	42	37
120			74	69.5	49	42
150			85	78.5	53.5	47
180				86	57	52
240					65	58
300					75	64
360					80	71
420					87	77
480						81
540						86

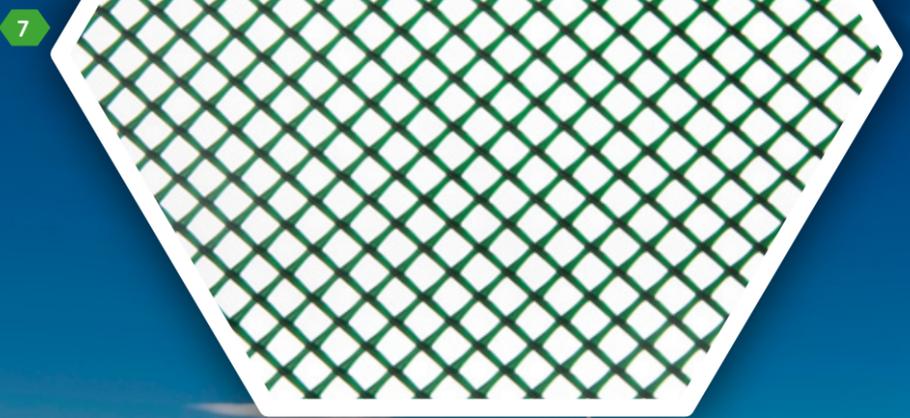
The test results obtained, as shown in the data table and line graph, provides specific data on the expected flow rates of the different EXPO-NET flow mesh products available. The data can be used to guide customers in the best choice of flow mesh products to use in different areas of a mould to match a specific resin

grade, laminate design (fibre reinforced, sandwich structure) and shape of the FRP part being infused.

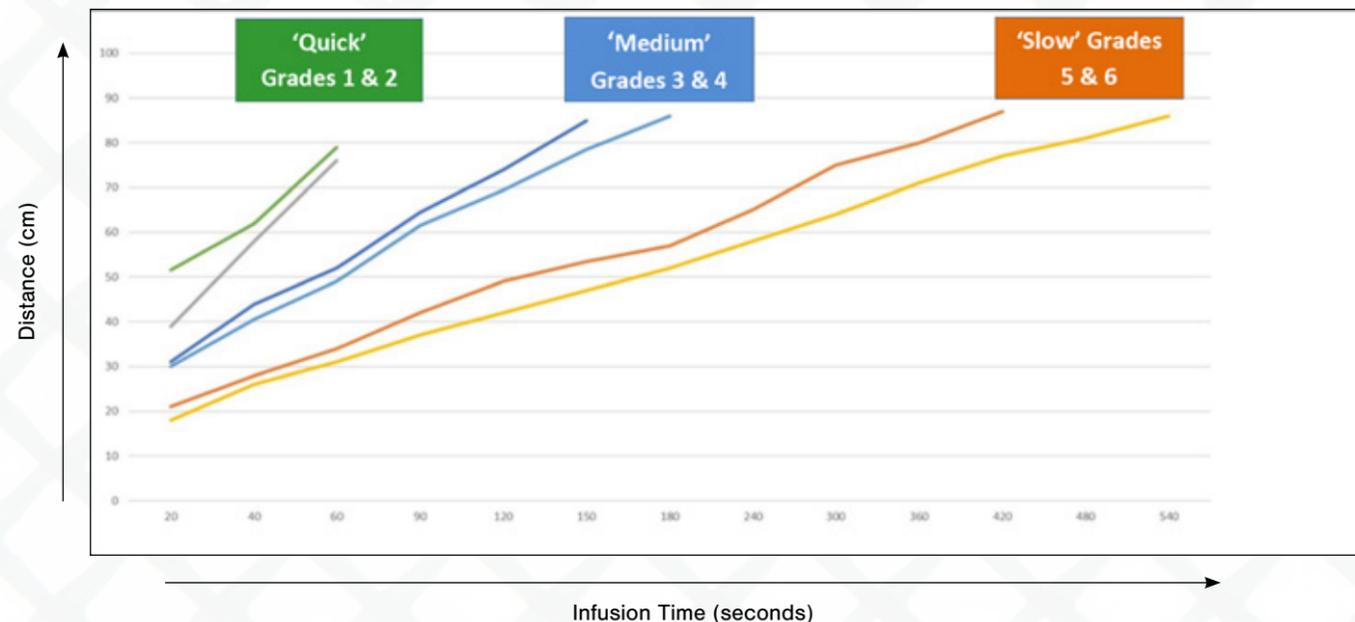
Having completed tests on the first set of six grade types, further tests will be carried this year to obtain flow test data for the rest of the EXPO-NET flow mesh range.

7: New bio-attributed EXPO-NET resin flow mesh and netting products being developed will be 100% recyclable and have a lower CO2 footprint.

8: EXPO-NET has been a green business committed to the environment since 2009.



Graph of Vacuum Infusion Test Data by EXPO-NET Resin Flow Mesh Grade Type



2 New Bio-attributed plastic netting products

EXPO-NET's R&D team is investigating possible bio-attributed thermoplastic polymer formulations that can be extruded to provide netting and flow mesh products with properties which match the specifications of currently used PE and PP polymer raw materials. The renewable 'mass balance' resource feedstocks being evaluated can be produced from tall oil extracted from kraft pulped Nordic softwoods. The aim is to develop a new range of sustainable products of equivalent performance that are not only 100% recyclable, but also have a significantly lower carbon footprint.

During JEC World 2023, the EXPO-NET business development team is hoping to meet with companies interested in

discussing a possible collaboration to develop bio-attributed resin flow mesh products for their specific market and application needs.

Sustainability Commitment

The company has been committed to being an environmentally responsible business since 2009. Over the last 14 years, EXPO-NET has invested in a number of 'green' projects. Initial projects included: switching to low energy lighting; developing ways to regrind and reuse any waste materials, selling the rest to polymer reprocessors to be recycled; switching to using clean energy. For many years, 100% of the internal waste materials produced are reused and 80% of the site's electricity comes from clean, renewable energy suppliers.

In recent years, more complex sustainability projects to reduce waste and energy use on site involved investing in equipment and technologies to filter and reuse processed wastewater and to capture and reuse heat from the plant. EXPO-NET has also installed charging points in the car park for electric vehicles.

Being acutely aware of the need to help address global climate change, EXPO-NET is continuing its commitment to reduce its carbon footprint and become net zero by working with low carbon suppliers and by finding ways to manufacturing more sustainable products in the future. ■

For more information go online to [www.expo-net.com](http://www.expo-net.com)