Specification for the management of labels and environmental assertion according to the ISO 14021 applied standard for 4T FORTE™ membrane used for sailmaking produced by Flexon Composites.

Product description and background

Flexon composites is the high-tech business unit that OneSails has dedicated to the realization of 4T FORTE™ membranes, headed by Eng. PierCarlo Molta one of the world's leading experts who has been involved in the development of flexible composite materials for more than 25 years.

The 4T FORTE™ technology has found application, among all others, in the production of sails for both recreational, sport and commercial use. The most widely used material in the production of modern sails is polyethylene terephthalate (polyester) brute formula (C10H8O4)xN ; it is known as Dacron (trademark registered since 1951 in the U.S. by DuPont) but it is also present under other names such as Terylene (trademark registered in Britain by Imperial Chemical Industries since 1941) , Tetoron, Trevira, Diolen . It is a very durable material with good UV resistance, resists bending and is also affordable. It is particularly suitable for sails that are asked to last a long time and are not required to have high performance. But its elongation resistance is notadequate for high-performance sails, particularly for fast boats with modern sail plans so other materials such as Pentex® (Polyethylene Naphtalene), Kevlar®, Carbon, Dyneema®, Vectran® (Aromatic Polyester) are used for these types of boats.

The membranes made by Flexon, being intended for the production of sails for racing and pleasure boats, are necessarily different and their dimensions and characteristics depend on the sail plan of the boat and the type of use (sport or pleasure). Therefore, each membrane constitutes a unique piece that, however, uses the same materials in varying quantities by the same process with different energy absorptions.

The materials used are all PE-based (HDPE, LDPE, PE, PET, UHMWPE) in varying quantities depending on the membrane produced. However, the different quantities do not result in significant variability for the purposes of the two requirements covered by the first two assertions (design for disassembly and recyclability). Therefore, the tests/assessments reported in this document and related to individual sail specimens can be considered representative of all membranes for 4T FORTE™ sails.

The sample of membranes subjected to the calculation was selected from the sails made for the *Medallia* boat that in 2020/21 participated in the Vendee Globe, a solo round-the-world non-stop race: given the demanding test to which they were subjected, these membranes involved the use of materials in excess of the standard and thus represent the “worst” specimens from the point of view of emissions generated.

Specific Requirements and supporting evidence

Elements supporting the declaration of Disassemblability

Production cycle, materials used, OneSails involvement (distribution network)
Subjects involved:

OneSails Loft	Designs the sail according to the customer's requirements, completes the membrane with the necessary finishes; at the end of life disassembles the sail by separating the membrane from the finishes. the loft informs the buyer about the possibility of recycling the membrane at the end of life.
Flexon Composites	produces the membrane that forms the base of the sail
Buyer and user of the sail	At the end of the sail's life, returns it to the loft so that it can undergo the recycling/recovery procedure.

The process of making a sail involves:

- A sail design stage performed by the loft,
- The preparation of the sail base by cutting panels with a plotter
- Deposition of the structural elements according to the design and the overlapping of the various layers of the intended materials
- The application of vacuum and hot fusion of the layers with the “furnace.”

At this point the membrane consisting of one single piece is ready to be shipped the lofts for finishing work.

At Flexon Composites, the assembly and construction of the welded plastic membrane with a hot melt takes place. The membrane is made in one piece manufactured according to the sailmaker's design. It is supplied with parts already prefabricated (e.g. batten pockets, reinforcements etc.) to reduce as much as possible the accessory parts added by the sailmaker and increase the effectiveness of membrane recovery at the end of life.

The membrane is designed to be salvageable at the end of its life with the removal of accessory parts applied by the lofts (not included in the scope of this asseveration).

At the end of its use, all accessory parts are removed and the membrane, or at least most of it, is returned to its original state by removing all the parts added to enable its use by the user. The disassembled membrane is suitable for recycling in its entirety at sites that process PE at the end-of-life indicated by the PoliEco Consortium. Flexon Composite, based on experience, provides lofts with methods for effective separation of accessory components (see attached instruction: annex 1).

> *The loft, at the time of the supply contract to the customer, informs him of the possibility of recycling the membrane, after disassembly at the production loft.*

Example of the disassembly:

The experience made on the sails used for the Vendee Globe, the non-stop solo round-the-world race, by the boat Medallia is reported. Annotations and datas are given in the following attachment.

	Weight of shipped membrane (kg)	Weight of the recovered membrane (kg)	% recovery
IMOCA60 4T 229C(HV) J#2	26,7	21	79

Preparation of the membrane for recycling purpose

Having an end-of-life sail, certain steps must be taken to adjust the product and return it to the condition closest to its original state of supply in the form of a plain membrane (also called a 'raw membrane').

The operations refer to the removal of all those parts and accessories applied in the finish to allow mounting on the rigging, adjustment by connection points of the rigging, and reinforcements and protections in areas where stiffening is required or subject to interference with elements of the boat or deck equipment.

This should be done in the following manner:

- Dismantle all accessories made of metal or otherwise of rigid materials such as rings, boards, trolleys, slat restraining and adjusting organs, and also adjusting ropes, etc. each shall be sent for reuse or to its own recovery cycle or disposal as waste.
- Proceed to peel off any decorations applied with self-adhesive fabrics or vinyls, and any protections made with non-compatible fabrics composed e.g., of Kevlar® or other aramid fibers.
- Remove seams, reinforcements and stiffeners applied to corners and strengths in heavy fabrics, and all perimeter edging.
- Composite elements made of direct polyethylene derivatives such as dyneema® or lightweight covers made of PET fabrics may be waived for all these materials.
- Finally, with regard to delivery methods, it may be necessary to cut the membrane into pieces in the approximate size of 1.5 sq. m. approx.

It should be noted that it will always be preferable to unstitch and remove the parts rather than to cut that also involves the underlying membrane, which would produce a certain reduction in the mass of recoverable material.

Supporting elements of the Recyclable statement.

Subjects involved:

Flexon Composites	Manages the collection of disassembled membranes with the OneSails lofts network
PoliEco	Through its network of member-owning polyethylene recovery companies, it offers Flexon the opportunity to contribute membranes obtained from disassembly at the end of sail life for recycling into reusable PE granules.

The membrane, which, being made of materials derived from Polyethylene (PE, HDPE, LDPE, PET) laminated and heat welded thanks to the absence of glues and/or resins can be subjected to recycling by extrusion , once the accessory components necessary for the functioning of the sail itself have been eliminated, in a normal production cycle of recovery.

Flexon, thanks to the collaboration of the PoliEco Consortium as the Consortium of PE recycling plants, has carried out tests to confirm the possibility of recycling the material, thus providing guidance to enable the network of polyethylene recycling plants to properly manage the material for recycling.

The treatment yields PE granules (not pure) but with the processability characteristics that allow it to be reused in the plastics industry.

The possibilities for effective membrane recovery thus depend on the presence of a collection network for disassembled sails and the presence of PE recycling plants.
In the absence of availability of the latter, Flexon Composite in cooperation with OneSails is able to perform collection of used membranes and send them for recovery at European plants.

Determination of carbon neutrality is based on, first, the calculation of a CFP (see 7.17.2.2), then the use of offsetting for reducing, removing or accounting for offsets equivalent to the emissions of the CFP. Alternatively, carbon neutrality can be achieved by a product whose CFP is zero.

Elements supporting the Assertion "Carbon Footprint of a Product (CFP) and Partial Carbon Footprint of a Product (Partial CFP)"

Flexon decided to adopt a calculation system based on the International Standard ISO/TS 14067/2018 considering it more dynamic than ISO 14040 so that it could design its products in compliance with objectives set by its ISO 14001 environmental management system.

The first result was to intervene on the most significant environmental aspect highlighted by the Initial Environmental Analysis, namely the consumption of electricity, which has been progressively reduced and has been derived from renewable production processes for 2 years.

To better evaluate possible improvements in GHG (greenhouse gas) emission reduction, a spreadsheet was created for a dynamic evaluation of emissions derived from materials and processes. The software was developed using data from the Simapro archive and is currently able to calculate the carbon footprint for each membrane produced.

The spreadsheet made according to the directions of the mentioned standard (ISO TS 14067/18) was applied to a series of 4T membranes of different grammage and size made by Flexon to calculate the CFP per kg of membrane.

ENVIRONMENTAL ASSURANCE COMPLIANCE WITH ISO 14021/2021 point 7.4

REGARDING THE MEMBRANE FOR SAILMAKING OF THE FLEXON COMPOSITES COMPANY

MEMBRANES MADE BY FLEXON COMPOSITES THAT ARE THE PRIMARY COMPONENT FOR THE MANUFACTURE OF BOAT SAILS

ARE DESIGNED AND MANUFACTURED TO:

BE ABLE TO BE DISASSEMBLED AT THE END OF THEIR LIFE FOR INCLUSION IN THE PE

ENVIRONMENTAL ASSURANCE COMPLIANCE WITH ISO 14021/2021 point 7.7

REGARDING THE MEMBRANE FOR SAILMAKING OF THE FLEXON COMPOSITES COMPANY

4T FORTE MEMBRANES MADE BY FLEXON COMPOSITES, WHICH ARE THE PRIMARY COMPONENT FOR THE MANUFACTURE OF BOAT SAILS

ARE DESIGNED AND MANUFACTURED TO:

BE ABLE TO BE RECYCLED BY EXTRUDER IN PE RECOVERY PLANTS DUE TO THE PRESENCE OF THE NETWORK OF SPECIALIZED PE RECYCLING OPERATORS

ENVIRONMENTAL ASSURANCE IN COMPLIANCE WITH ISO 14021/2021 section7.17

CONCERNING MEMBRANE FOR SAILMAKING FROM FLEXON COMPOSITES COMPANY

4T FORTE MEMBRANES MADE BY FLEXON COMPOSITES, WHICH ARE THE PRIMARY COMPONENT FOR THE MANUFACTURE OF BOAT SAILS

ARE MADE WITH CONTROLLED MATERIALS AND PROCESSES WITH THE AIM OF CONTAINING CARBON DIOXIDE EMISSIONS (CARBON FOOT PRINT) TO THE LOWEST LEVEL COMPATIBLE WITH THE FUNCTIONAL CONFORMITY OF THE PRODUCED GOOD; CURRENTLY, THE EMISSIONS CALCULATED USING THE CALCULATION SYSTEM IN ACCORDANCE WITH THE 14067/2018 STANDARD ON A REPRESENTATIVE SAMPLE OF MEMBRANES, ARE BETWEEN

6.60 and 7.67 kg CO2 / kg MEMBRANE

As an indication for comparison, the emissions of a Dacron fabric of equivalent weight (thus much less strength) are more than 10 kg CO2 / kg of FABRIC