CORE *TECHNICAL REFERENCE*

Marlow's Grand Prix Series offers a range of core options using Dyneema®, Vectran® and Zylon® (PBO). Each material has its own particular strengths and weaknesses.

Dyneema® offers by far the best strength to weight ratio of any material used in rope manufacture and is the material of choice for high performance cores. At Marlow we offer a range of Dyneema® cores to suit strength and handling preferences as well as budget.

Dyneema® is an Ultra High Molecular Weight Polyethylene (UHMWPE) and is available in a number of different grades. All grades of Dyneema® have excellent fatigue resistance (cyclic bending), UV resistance and abrasion resistance, but have poor heat resistance due to a relatively low melting point.

- SK78 is now the standard material offering very high strength but significantly improved creep characteristics over it's predecessor SK75 or equivalents.
- SK99 is the very latest Dyneema® material. It offers exceptional strength (some 20% higher than SK78) and is unmatched in terms of strength to weight ratio.
- DM20 has slightly lower tenacity than SK78, but has one major advantage in that it exhibits virtually zero creep, which can often have a negative affect on a rope's performance and strength, at high loads for an extended period.

Vectran® (LCP) has the best creep performance of any synthetic fibre and can offer improved resistance to heat compared to the UHMPE family.

Zylon® (PBO) offers unrivaled strength/diameter performance coupled with exceptional resistance to heat and ultra low elongation. PBO is very susceptible to UV degredation.

STRENGTH

The graphs below illustrate the comparative strengths of different core materials, based upon a 9mm core used in a 12mm rope.

Fig. 1 shows the relative strengths of 9mm ropes made with different materials. However, whilst displaying break strengths comparable or better than Dyneema®, the additional weight of Vectran® and Zylon® (PBO) ropes (Fig.2) cannot compare to the strength to weight ratio of Dyneema® (Fig.3), illustrating why Dyneema® is preferred by the majority of racers.

PRE-STRETCHING AND MARLOW MAX TECHNOLOGY

Every Marlow Dyneema® core is pre-stretched to reduce "bedding in" elongation, limit the amount of elastic elongation and improve rope strength. We have been pre-stretching Dyneema® cores for over 25 years and that experience means we know exactly how to improve the rope's performance without compromising flexibility or damaging the fibre.

Marlow's MAX Technology uses a precisely controlled process to take Dyneema® to the limits of heat and load during Pre-Stretching. Introduced to offer the ultimate in strength realization from the fibre and to minimize elastic and "bedding-in" elongation, MAX ropes are stiffer than standard pre-stretched cores.

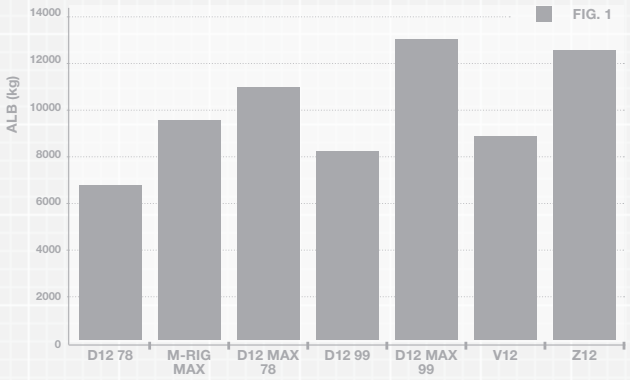
A BLUE OCEAN® INITIATIVE

As of 2020, all of our standard SK78, SK99 and DM20 products are made using bio-based Dyneema® fibre.

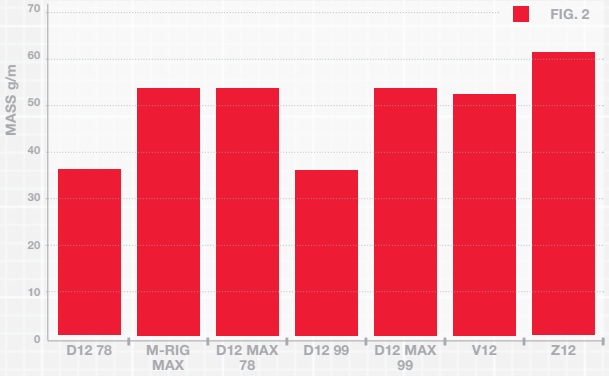
See page 55 for more information

For more information about bio based Dyneema® yarn, visit page 55.

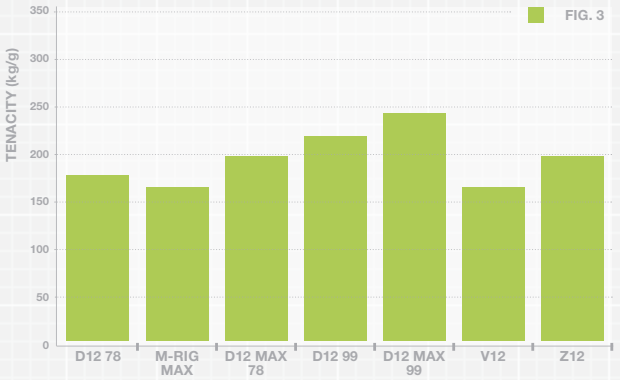
CORE STRENGTH COMPARISON
9mm (CORE FOR 12mm ROPE CORE STRENGTHS)



CORE WEIGHTS (mm)



TENACITY (kg/g)



MATERIAL ELONGATION COMPARISON GRAPHS

These graphs show the relative elongation of Dyneema® SK78 and SK99 to Vectran® and Zylon® (PBO).

When elongation is measured as a % of break load (fig. 4), it is shown that whilst Zylon® offers the lowest elongation followed by Dyneema® in D12 Max and then D12, there is no differential between SK78 and SK99. However, when elongation is measured at a given load (for example 4,000kg), which is more relevant to specifying rope for on board applications (fig.5), it can be seen that the advantages of SK99 over SK78 in terms of elongation are clear. This is because the rope is working at a lower percentage of the its break load.

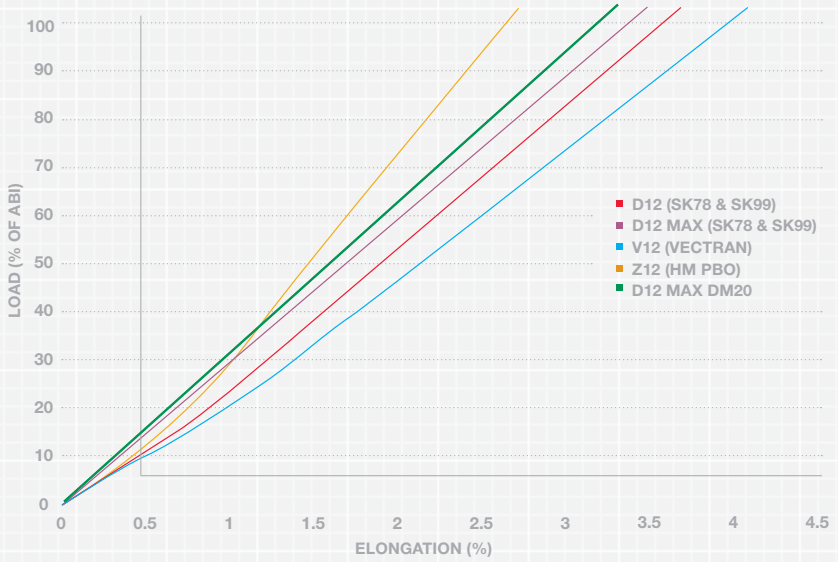
However, as Dyneema® exhibits creep, it is important to understand how this affects Dyneema's elongation characteristics.

The extension over time graph (Fig. 6) shows how Dyneema® ropes behave over a period of time.

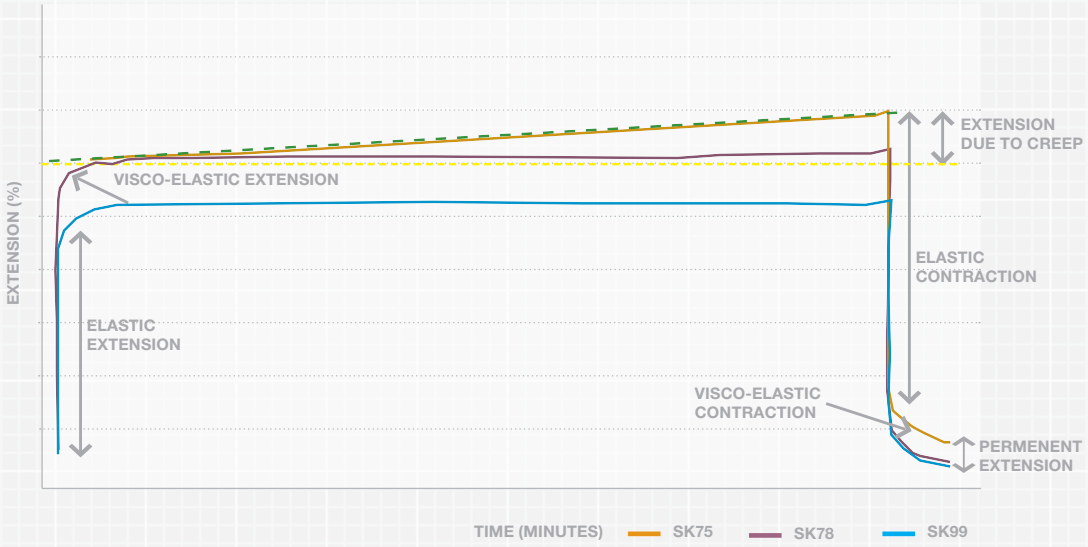
- Initial loading will result in elastic extension. This is immediate upon loading and is immediately recoverable upon release of the load (elastic contraction)
- After the elastic extension of the initial loading, the rope will experience what is known as viscoelastic extension. This is further extension over time and is fairly limited. Unlike elastic stretch that is immediately recoverable, viscoelastic stretch will recover slowly over time once the load is released.
- Finally there is creep, which is permanent, non-recoverable and time dependent. Creep occurs at the yarn molecular level when the rope is under constant load.
- Once the load is released and elastic and viscoelastic extension recovered, the rope will ultimately have experienced an element of permanent extension. This is a factor of both creep and "bedding in" which is when individual fibre components in the rope and / or splice settle into their preferred position when under load.

Vectran® and Zylon® (PBO) exhibit virtually zero creep and Zylon also has lower elastic elongation than Dyneema®.

LOAD EXTENSION (%/%) - FIG. 4



EXTENSION OVER TIME GRAPH - FIG. 6



LOAD EXTENSION OF 9mm CORES (%/kg) - FIG. 5