Fatigue resistance. Dyneema® fiber applications have a higher resistance to repeated axial loading than other fiber types. The fibers combine high strength with high fatigue resistance, even if the loading is partly in compression as in repeated bending of rope applications. Despite its high modulus, the fibers are flexible and have a long flexural fatigue life. Because of the low friction coefficient and good abrasion resistance, internal abrasion of ropes is usually negligible.

**FATIGUE RESISTANCE**

<table>
<thead>
<tr>
<th>Fiber type</th>
<th>Tensile strength</th>
<th>Tensile modulus</th>
<th>Elongation to break %</th>
</tr>
</thead>
<tbody>
<tr>
<td>SK78</td>
<td>3.4 – 4.0</td>
<td>38 – 45</td>
<td>3.3 – 3.9</td>
</tr>
<tr>
<td>SK75</td>
<td>3.4 – 4.0</td>
<td>38 – 45</td>
<td>3.3 – 3.9</td>
</tr>
<tr>
<td>SK65</td>
<td>2.5 – 3.4</td>
<td>28 – 38</td>
<td>2.4 – 3.3</td>
</tr>
<tr>
<td>SK60</td>
<td>2.5 – 3.4</td>
<td>28 – 38</td>
<td>2.4 – 3.3</td>
</tr>
<tr>
<td>SK25</td>
<td>2.2</td>
<td>25</td>
<td>2.2</td>
</tr>
</tbody>
</table>

**ENVIRONMENTAL PROPERTIES**

- Visible light exposure: Excellent
- UV-exposure: ISO 4892, Very good
- Weathering: ISO 12224, Excellent
- Oxidation (28 days, 80°C, 50 bar): ISO 13438, Passed

**Fungal resistance.** Dyneema® fiber has excellent biological resistance. The fiber neither stimulates undesired growth nor is sensitive to any attack by micro-organisms.

**Toxicity.** Polyethylene is regarded as biologically inert. The Dyneema® fibers are IARC classified 3 (not classifiable carcinogenic to human) based upon its length weighted geometric mean diameter. This diameter is too large to produce respirable fibers, meaning they will never reach the deeper part of the respiratory tract and fibrogenic or carcinogenic effects on the lung will not occur.

**Environmental properties.** Dyneema® fiber is used in various outdoor applications under harsh weather conditions. In air the fiber is stable for many years. No special precautions are necessary during processing or storing. Only strong oxidizing media are able to attack the mechanical properties. Compared to other high tenacity fibers, long term exposure to UV shows the lowest decrease in strength and elongation at break.

**Weathering.**

- Visible light exposure: Excellent
- UV-exposure: ISO 4892, Very good
- Oxidation (28 days, 80°C, 50 bar): ISO 13438, Passed

**Fungal resistance.**

- Aspergillus niger: RTCA DO160, Excellent
- Aspergillus flavus: RTCA DO160, Excellent
- Aspergillus versicolor: RTCA DO160, Excellent
- Penicillium funiculosum: RTCA DO160, Excellent
- Chaetomium globosum: RTCA DO160, Excellent
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ELECTRICAL
Resistance >10¹⁴ Ohm
Dielectric strength 900 kV/cm
Dielectric constant (22 °C, 10 GHz) 2.25
Dielectric loss factor 0.0002

PHYSICAL
Natural color Opaque white
Density 970 – 980 kg/m³
Crystallinity < 85 %
Filament linear density 1 – 3 dpf
Coefficient of linear thermal expansion -12 x 10⁻⁶ 1/K
Specific heat capacity 1850 J/kg.K
Thermal conductivity (axial) 20 W/m.K
Thermal conductivity (transverse) 0.2 W/m.K

Chemical resistance. Dyneema® fiber is very resistant against chemicals. Because it is produced from ultra high molecular weight polyethylene, it does not contain any aromatic rings or any amide, hydroxyl or other chemical groups that are susceptible to attack by aggressive agents.

Chemical resistance to acids. Excellent*
Chemical resistance to alkali. Excellent*
Chemical resistance to most chemicals. Excellent*
Chemical resistance to water. Excellent*
Chemical resistance to solvents. Excellent*
Chemical resistance to cleaning fluids. Excellent*
Chemical resistance to inorganic salts. Excellent*
Chemical resistance to polyethylene glycol. Excellent*
Chemical resistance to insecticides. Excellent*
Chemical resistance to fire extinguishant. Excellent*

Acoustic properties. Dyneema® fiber has a high sonic velocity. In the fiber direction, the sonic velocity is higher than in the transverse direction. The acoustic impedance, the product of density and transverse sonic velocity, is near that of water.

Sonic velocity (axial) 10000 – 12000 m/s
Sonic velocity (transverse) 2000 m/s

Flammability. Fabrics and panels produced from Dyneema® fibers have passed various standards on flammability. Like any other synthetic fiber, it will burn slowly if ignited in atmospheric conditions and is qualified as being self-extinguishing upon removal of the flame.

 ultraviolet (UV) Transparent
Eye visibility (VIS) Translucent
Near infrared visibility (NIR) Highly transparent
Infrared visibility (IR) Highly transparent
Radar visibility Highly transparent
Refractive Index (axial) 1.59
Refractive Index (transverse) 1.53
Birefringence 0.06

MECHANICAL
Free breaking length 378 km
Axial tensile strength 3.6* GPa
Axial tensile modulus 116* GPa
Axial compressive strength 0.1 GPa
Axial compressive modulus 116 GPa
Transverse tensile strength 0.03 GPa
Transverse modulus 3 GPa
Transverse compressive strength 0.1 GPa
Elongation at break 3 – 4 %
Work to break 45 – 70 MJ/m²
Creep at 30°C, 300 MPa (Dyneema® SK75) 0.02% /day
Creep at 30°C, 300 MPa (Dyneema® SK78) 0.006% /day

Thermal properties. Like other synthetic fibers, the mechanical properties of HMPE fibers are influenced by temperature. The strength and modulus increase at sub-ambient temperatures and decrease at higher temperatures. For long duration exposure Dyneema® fibers can be used from cryogenic conditions up to a temperature of 70°C.

Relative to 23°C
-60°C +23°C +60°C +100°C
Tensile strength 110% 100% 80% 55%
Tensile modulus 110% 100% 85% 60%
Elongation at break 90% 100% 100% 100%

Thermal properties.

MECHANICAL

THERMAL
Melting range 144 – 152 °C
Decomposition temperature > 300 °C
Advised lowest temperature No limit
Advised long duration temperature limit 70 °C
Advised short duration temperature limit (non-constrained fiber) 130 °C
Advised short duration temperature limit (constrained fiber) 145 °C
Coefficient of linear thermal expansion -12 x 10⁻⁶ 1/K
Specific heat capacity 1850 J/kg.K
Thermal conductivity (axial) 20 W/m.K
Thermal conductivity (transverse) 0.2 W/m.K

Chemical resistance.

CHEMICAL RESISTANCE
Resistance to acids. Excellent*
Resistance to alkali. Excellent*
Resistance to most chemicals. Excellent*
Resistance to water. Excellent*
Aviation Jet A fuel (ISO 1817 test liquid F) RTCA DO160 Excellent
Hydraulic fluid (ISO 1817 test liquid 100) RTCA DO160 Excellent
Lubricating oil (ISO 1817 test liquid 101) RTCA DO160 Excellent
Solvents and cleaning fluid (Isopropyl alcohol) RTCA DO160 Excellent
De-icing fluid (Ethylene glycol) RTCA DO160 Excellent
Insecticide (Pyrethroid pesticide) RTCA DO160 Excellent
Fire extinguishant (Protein, Fluorprotein) RTCA DO160 Excellent

Electrical properties.

ELECTRICAL
Resistance >10¹⁴ Ohm
Dielectric strength 900 kV/cm
Dielectric constant (22 °C, 10 GHz) 2.25
Dielectric loss factor 0.0002

Optical properties.

OPTICAL
Ultraviolet visibility (UV) Transparent
Eye visibility (VIS) Translucent
Near infrared visibility (NIR) Highly transparent
Infrared visibility (IR) Highly transparent
Radar visibility Highly transparent
Refractive Index (axial) 1.59
Refractive Index (transverse) 1.53
Birefringence 0.06

Fabric, horizontal FMVSS 302 Passed
Fabric, vertical FAR 25.853b Passed
Ballistic panel, vertical DIN 4102 Passed

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