



## PANOLIN STELLA MARIS – Executive Summary



### What is PANOLIN STELLA MARIS?

PANOLIN STELLA MARIS is a fully synthetic, high performance, readily biodegradable, non-toxic lubricant made from saturated esters, specifically developed for Stern Tubes. It is combined with high-grade anti-wear additives, is zinc-free and is environmentally friendly. PANOLIN STELLA MARIS is a 100 % saturated synthetic ester based stern tube lubricant and is part of the PANOLIN GREENMARINE product range.

### What makes PANOLIN STELLA MARIS better?

- Leaves no rainbow sheen when spilled in water
- Oxidation resistant at high temperatures, prevents gumming and deposits of ageing products (shellac)
- Extremely long oil-change interval; decreased downtime and maintenance costs
- Outstanding high-pressure characteristics
- Excellent cold-flow characteristics
- Excellent corrosion and wear protection
- Is non-emulsifying
- Does not affect state-of-the-art sealing materials
- Promotes your environmentally considerate «green» image

### Where can I use PANOLIN STELLA MARIS?

- Stern tubes

### What is biodegradability?

PANOLIN STELLA MARIS is readily biodegradable, meaning it is fully decomposed by soil and water microorganisms. These microorganisms consume the oil, leaving natural substances like carbon dioxide, water and mineral salts in its place.

### What tests and standards are there for biodegradability?

According to well-known eco standards eg. Swedish Standard, EEL – European Eco Label:

- ASTM D 5861 (EM 1110-2-1424)
- Method OECD 301B, Organization for Economic Cooperation and Development (OECD)
- Method EPA 560/6-82-003, number CG-2000, adapted by the U.S. Environmental Protection Agency (EPA), Test and Test Method is exactly the same as the OECD 301B Test (resp. ISO 9408)

*These tests determine the rate and extent of aerobic aquatic biodegradation under laboratory conditions.*

### What is toxicity?

A lubricant is generally considered aquatic non-toxic if a concentration of greater than 1 000 ppm of the material in an aqueous solution is needed to achieve a 50 % mortality rate in the test organism.

### What tests and standards are there for toxicity?

According to well-known eco standards eg. Swedish Standard, European Eco Label (EEL):

- EPA 560/6-82-002
- OECD 201: algae, OECD 202: daphnia, OECD 203: fish, OECD 207: earth worms, OECD 208: growth inhibition-plants, OECD 209: activated sludge

*These tests determine the concentration of a substance that produces a toxic effect on a specified percentage of test organisms in defined time.*

### What certifications do PANOLIN STELLA MARIS hold?

- Europe: European Eco Label
- Germany: VwVwS: WGK-1 (water hazard classification)

### What types of biodegradable fluids are there?

Based on ISO 6743 and related to ISO 15'380 for environmentally acceptable lubricants, there are **four** categories of bio hydraulic fluids:

- 1) HEPG** Polyglycols (polymers of ethylene or propylene oxides) used as a synthetic lubricant base; good hydrolytic stability, high VI, low volatility; water soluble.

#### Characteristics

- Water emulsion leads to the formation of steam bubbles at operating temperature, which may cause cavitation of pumps and de-rating of components
- No water separation capabilities; excess water can only be boiled off
- Incompatibility with paints, filter materials, gaskets and seals
- Cannot be mixed with mineral oils; mixing can cause catastrophic failure to a hydraulic system
- Aquatic toxicity when mixed with lubricating additives and can bio-accumulate
- Excellent low-temperature flow capabilities
- Excellent high-temperature oxidation stability
- No rust prevention
- Excellent hydrolytic stability

- 2) HEPR** Polyalphaolefins (PAO) and related hydrocarbon products.

#### Characteristics

- Limited shear stability
- Uses viscosity index improvers
- Produces rainbow sheen on water
- Regular oil changes needed
- Only low viscosities (<4/6 cSt @ 100°C/212 °F) are biodegradable
- To our best knowledge no HEPR is listed in the European Eco Label

- 3) HETG** Triglycerides also known as vegetable oil, rapeseed oil, sunflower oil, coconut oil, palm oil or soybean oil; these are biodegradable fluids that are vegetable or animal based.

#### Characteristics

- Very poor equipment performance
- Poor response to high temperatures, leading to frequent replacement
- Narrow viscosity operating range
- Rapid oxidation and poor thermal stability; Become dense and change composition at high temperatures; thicken and gel at low temperatures
- Good Biodegradability and Lubrication with excellent rust prevention qualities
- Can leave residues in hydraulic system (shellac)

**4) HEES** Synthetic Esters also known as petrochemical esters, these are made by reacting acids and alcohols from petrochemical processes. Two Types of HEES Synthetic Esters:

#### **Characteristics – Unsaturated Esters**

- Have a pour point of approx.  $-30^{\circ}\text{C}/-22^{\circ}\text{F}$
- Have iodine number of more than 15
- Downtime required for regular oil changes
- Poor thermal and oxidation stability, increase in viscosity with increase in temperature
- Can leave residues in hydraulic systems (shellac)
- Subject to water emulsification; very poor water separation
- Can leave rainbow sheen on the water when spilled
- Only operate with low to medium pressures

#### **Characteristics – 100% Saturated Esters (PANOLIN STELLA MARIS)**

- In saturated compounds the double bonds are removed; no such weak chemical bonds are present
- Have iodine number of less than 15
- Excellent thermal and oxidation stability, no increase in viscosity with increase in temperature
- Hydraulic components kept clean, no ageing deposits
- Good oxidation stability means excellent long-term performance
- Separates from water easily and quickly due to fully saturated ester compound
- No rainbow sheen on the water if spilled
- Can operate at high pressures with no issues
- Excellent rust prevention
- Works well with nearly all sealing materials

#### **Why are the bonds in Unsaturated Esters important?**

Unsaturated esters have double bonds, while saturated esters do not. Such weak chemical bonds interact with oxygen quickly, which leads to an oxidation (ageing) of the unsaturated ester-based hydraulic fluids. This ageing leads to extreme thickening and gumming, deposits, (shellac), which will can lead to major catastrophic failures.

#### **What is an Iodine Number?**

An Iodine Number identifies the quantity of double or triple carbon bonds. The more bonds, the higher the Iodine Number. The higher the Iodine Number, the greater number of bonds to interact and oxidize – making for big problems in your hydraulic system. PANOLIN STELLA MARIS has an Iodine Number of less than 15 for all viscosities.

#### **What is a Pour Point?**

The Pour Point of a fluid is the lowest temperature at which a fluid will flow or pour, and basically the coldest temperature at which you can still pump the fluid.

PANOLIN STELLA MARIS has a pour point of approx.  $-35^{\circ}\text{C}/-31^{\circ}\text{F}$ .

Viscosity is basically the thickness of a fluid. The thicker the fluid is, the higher the viscosity. The viscosity index (VI) is a numbered scale that indicates changes in viscosity as the temperature changes. A high viscosity index indicates small changes in oil viscosity with changes in temperature. Low VI would be below 35, medium VI would be 35 to 80, high VI would be 80 to 110, and very high VI would be above 110.

PANOLIN STELLA MARIS has a viscosity index ranging from 146 to 156, meaning its viscosity is very stable across a wide range of temperatures.

### What is the Flash Point?

The Flash Point of a fluid is the lowest temperature at which a hydraulic fluid emits enough vapor to ignite in the presence of a flame. Once the flame is removed, the fluid will stop burning.

PANOLIN STELLA MARIS has a Flash Point ranging from 220°C to 240°C/428°F to 464°F, dependent upon the viscosity of the fluid.

### What is the RPVOT Test?

The RPVOT (Rotating Pressure Vessel Oxidation Test), is a test used to monitor oils for losses in oxidation resistance and increases in acid levels. Heat combined with exposure to water, air and metal are the driving forces behind oxidation, and will create acids and other by-products which will stick to surfaces in your hydraulic systems. While the performance of

## Important things to know when selecting a fluid

### 1. Inherently biodegradable vs. readily biodegradable

The European Eco Label defines a biodegradation level > 60 % acc. to mineralization methods to indicate readily biodegradation for lubes.

The ranking of biodegradability in well-known ecolabels, tested in 28 days, follows:

Non-biodegradable	less or equal to 20 %
Inherently biodegradable	between more than 20 % and 60 %
Readily biodegradable	more than 60 %

Typically, mineral oils are inherently biodegradable, which indicates their persistency in the environment being very high.

PANOLIN STELLA MARIS is readily biodegradable, meaning that 60 %, (PANOLIN is actually better than this, and this percentage varies based on the viscosity), of the fluid will be converted to CO<sub>2</sub> and water within 28 days.

### 2. Not all biodegradable fluids are non-toxic and not all non-toxic fluids are biodegradable

PANOLIN STELLA MARIS is actually both non-toxic and biodegradable. However, not all fluids available are both, and you must pay attention to these claims. To be a truly environmentally-friendly fluid, you must be both non-toxic to animal and plant life, and leave a minimal footprint on your environment. PANOLIN accomplishes this.

### 3. Not all synthetic esters are saturated synthetic esters

There are both saturated and unsaturated ester-based fluids available on the market today, and many are just advertised as «synthetic esters». Look at the Iodine Numbers, the pour points, and the RPVOT test results. Many unsaturated ester manufacturers will not even put their Iodine Number in their literature.

## Make sure you ask so you know what product you are really getting!