



## PANOLIN HLP SYNTH – Executive Summary

### What is PANOLIN HLP SYNTH?

PANOLIN HLP SYNTH is a fully synthetic, high-performance, readily biodegradable, non-toxic hydraulic fluid made from saturated esters. It is combined with high-grade additives, is zinc-free, is environmentally friendly, and is available for a wide variety of applications.

PANOLIN HLP SYNTH is a 100 % synthetic saturated ester hydraulic oil complying with VDMA 24568, (synthetic esters insoluble in water), and the ISO 15380 HEES classification.

### What makes PANOLIN HLP SYNTH 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; considered to be lifetime-fill; decreased downtime and maintenance costs
- Outstanding high-pressure characteristics
- Excellent cold-flow characteristics; extremely low pour point of  $-60^{\circ}\text{C}/-76^{\circ}\text{F}$
- Excellent corrosion and wear protection
- Does not affect state-of-the-art sealing materials
- Proven Records: 30-year pedigree with over 1-billion operating hours of experience
- Has passed tests 10 times longer than the ASTM D 2070 test requires
- Fine Filtered to  $5\ \mu\text{m}$ , (ISO 4406 = 19/16/13)
- Promotes your environmentally considerate «green» image

### Where can I use PANOLIN HLP SYNTH?

- Earthmoving and Forestry hydraulic systems
- Industrial and Construction hydraulic Equipment
- Hydro Electric hydraulic Equipment
- Offshore and Subsea hydraulic Equipment
- Compressors, bearing lubrication and oil circulation systems
- Plastic Injection Molding Machines (field tested well over 100 000 hours without any oil changes)

### What is biodegradability?

PANOLIN HLP SYNTH 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, 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 or hydraulic fluid is generally considered 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 the Army Corps of Engineers EM 1110-2-1424:

- 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 96 hours.*

### What are the United States EPA Standards and regulations for hydraulic fluids?

According to the Army Corps of Engineers EM 1110-2-1424:

- The environmental impact is cumulative and consequently harmful to plant, fish and wildlife
- There must be no visible oil sheen evident if spilled, and the point of use discharges should not exceed 10ppm

### What certifications do PANOLIN HLP SYNTH/ PANOLIN HLP SYNTH E hold?

- ASTM D-6046-98a: PW1, TW1, TS1
- Biodegradability (average): > 60 % to OECD 301 B, within 28 days
- USA: USDA BioPreferred
- Austria: ÖNORM part 5
- Croatia: Eco Label
- Czech Republic: Eco Label
- Europe: European Eco Label
- Germany: Der Blaue Engel, Award for biodegradability  
VwVwS-Water hazard classification: PANOLIN HLP SYNTH 15 – 32: nwg, PANOLIN HLP SYNTH 46 – 68: WGK-1
- Great Britain: Environmental Agency Standards
- Holland: VAMIL Regulations
- Japan: Eco Mark, JEA (Japan Environment Association)
- Korea: Eco Label
- Sweden: Swedish Standards SS 15 54 34

### How has it been tested?

Aside from testing performed by manufacturers and OEMs around the world, PANOLIN HLP SYNTH performance has been monitored internally for over 30 years. It has been proven as a long-term fill solution for more than 100 000 machines.

### What types of biodegradable fluids are there?

Based on ISO 15380 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/210 °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 HLP SYNTH)**

- Have a lower pour point of at least  $-50^{\circ}\text{C}/-58^{\circ}\text{F}$ , excellent reaction in cold start-up temperatures
- Have iodine number of less than 15
- In saturated compounds the multiple bonds are removed; no multiple bonds are present
- 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 of hydraulic systems
- 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
- In most cases mixable with mineral oil
- 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 in hydraulic systems. PANOLIN HLP SYNTH is a saturated ester-based fluid, which exceeds the requirements of ISO 15380 for HEES type fluids.

**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 HLP SYNTH 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 HLP SYNTH has a pour point ranging from  $-60^{\circ}\text{C}$  to  $-53^{\circ}\text{C}/-76^{\circ}\text{F}$  to  $-63^{\circ}\text{F}$ .

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 HLP SYNTH 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 HLP SYNTH has a Flash Point ranging from  $220^{\circ}\text{C}$  to  $240^{\circ}\text{C}/428^{\circ}\text{F}$  to  $464^{\circ}\text{F}$ , 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 saturated esters is superior, you may be surprised to know that unsaturated esters fail to outperform even standard mineral oil hydraulic fluids.

### Who has used PANOLIN HLP SYNTH?

There are dozens of Original Equipment Manufacturers, as well as manufacturers of hydraulic components, who have tested and used PANOLIN HLP SYNTH successfully. By reducing downtime, increasing performance, and promoting their environmentally-friendly image, some have even specified PANOLIN HLP SYNTH to be the exclusive, or preferred biodegradable fluid for use in their equipment. Ask your representative for test and approval documentation, and we will gladly provide this information to you.

## Important things to know when selecting a fluid

### 1. Inherently biodegradable vs. readily biodegradable

The European Eco Label defines a biodegradation level  $> 60\%$  according to mineralization methods to indicate readily bio-degradation for lubricants.

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 HLP SYNTH 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  $\text{CO}_2$  and water within 28 days.

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

PANOLIN HLP SYNTH 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!**