



BIOSYNTHETIC[®]
TECHNOLOGIES

HYDRAULIC FLUID

Biosynthetic[®] Technologies manufactures renewable and biodegradable base oils used to formulate high-performance hydraulic fluids. These uniquely patented oils can be used as an additive or as a base oil replacement.

To illustrate the superior functionality of these oils, Biosynthetic Technologies formulated the first renewable and biodegradable hydraulic fluid that is formulated to meet Ecolabel Performance requirements. It is manufactured with our patented BT22 Base Oil and a commercially available ashless additive package. The base oil imparts a novel combination of performance and environmental characteristics into the finished fluid while delivering superior hydrolytic stability and oxidative stability. The Biosynthetic Technologies BT22 sustainable base oil is a medium viscosity, lubricant base oil designed specifically to help customers in the lubrication industries meet their production quality standards as well as their environmental standards.

Since hydraulic fluids are exposed to the environment more than any other lubricant, it is essential to use a biodegradable base oil to ensure safety when entering the environment. Biosynthetic base oil BT22 is a renewable base oil that offers exceptional technical performance and environmental benefits. The additive package used in this formulation is optimized to satisfy a wide range of industrial and heavy-duty hydraulic equipment requirements. In addition, this product is formulated with highly effective ashless inhibitors to control oxidation, wear, corrosion and rust.

Biosynthetic base oils improves sustainability at each step of the life cycle analysis—production, manufacturing, use, and disposal. It is also compatible with existing recycling and re-refining infrastructure, continuing to reduce petroleum use through responsible collection practices.

Hydraulic Fluid Sample Formulation

USDA Certified Biobased*
Superior Oxidative Stability
Excellent Wear Performance
Superior Hydrolytic Stability
HX-1 Certified*
Biodegradable and Non-Toxic*
Excellent Performance Characteristics

These sample formulations have been created to assist our partners in formulating hydraulic fluids. However, they are not intended for commercialization.

Formulation Data

For this Biosynthetic Technologies hydraulic fluid sample formulation, the BT22 (ISO VG 150) and 1.25% ashless additive package was used. The finished lubricant shows excellent performance capabilities while being sustainable. This formulation offers a significantly higher Viscosity Index providing increased film thickness at elevated temperatures, resulting in better protection, and in many cases reduced wear. The formulation delivers superior oxidative stability when compared to commercially available environmentally friendly hydraulic fluids. Resulting in longer product life. Estolides have excellent hydrolytic stability and offer a unique ability for formulators to develop environmentally friendly products without sacrificing hydrolytic stability. This formulation delivers excellent copper results and little change in acid number in the water layer of the test suggesting excellent hydrolytic stability.

Applications

Ideal for use in a variety of hydraulic fluid applications that need to meet the EcoLabel requirements. Suitable for several hydraulic fluid applications in construction, industrial, agricultural, marine, mining and automotive applications where environmental and safety concerns are high. In marine applications, where US VGP 2013 requires environmentally acceptable lubricants, Biosynthetic Technologies Base Oils enable lubricant formulations to meet performance expectations where other mineral oil replacements fall short.

Biosynthetic Technologies Base Oil Performance Features

- High Oxidative Stability
- Low Volatility
- Excellent Anti-wear Performance
- High Viscosity Index
- Hydrolytic Stability
- Low Pour Point
- Natural Detergency
- Longer Lasting
- High Shear Stability
- Increased Safety
- Fewer Additives Needed
- Increased Stability
- Less Maintenance

Biosynthetic Technologies Base Oil Environmental Benefits

- High Biodegradability
- Low Bioaccumulation
- Low Toxicity
- High Bio-Content
- Low Environmental Risk
- Reduced Risk to Wildlife
- EcoLabel and VGP
- Renewable Carbon Based
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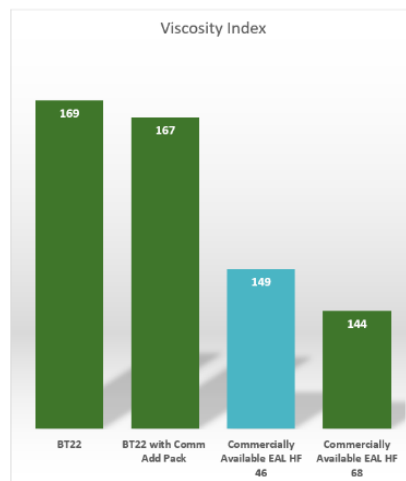
Certifications and Registrations



Viscosity Index

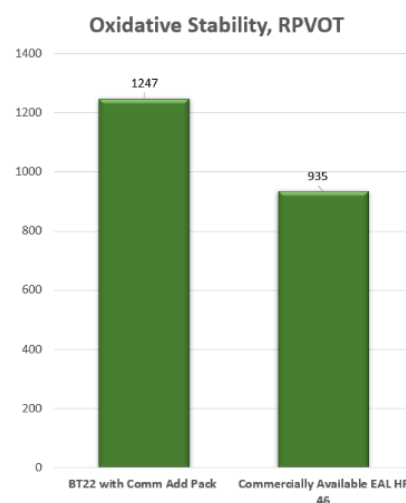
Because Estolides have higher VIs than most products, they have several advantages over other base oils:

- Higher VI fluids provide increased film thickness at elevated temperatures, resulting in better protection, and in many cases reduced wear.
- At lower temperatures, high VI base fluids display a lower rate of viscosity increase resulting in reduced viscous drag on moving parts, leading to higher horsepower output and increased energy efficiency.



Oxidative Stability

BT22, offers superior oxidative stability when compared to commercially available environmentally friendly hydraulic fluids; resulting in longer product life.



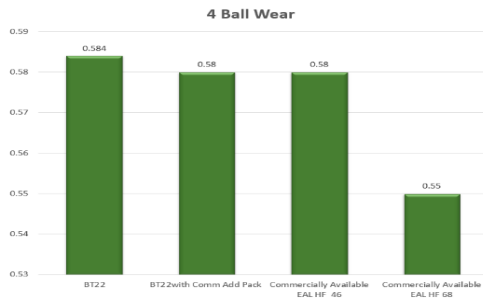
Hydrolytic Stability

Estolides have excellent hydrolytic stability and there offer a unique ability for formulators to develop environmentally friendly products without sacrificing hydrolytic stability. This hydraulic fluid formulation passed with hydrolytic stability testing with excellent copper results and little change in acid number in the water layer of the test suggesting excellent hydrolytic stability.

Property	Unit	Parker Denison Limit	BT22 + Comm Adpack	Commercial EAL HF 32	Commercial EAL HF 46
Copper Weight Loss	mg/cm ²	0.2 max	0	0	0
Copper Appearances	rating	-	1b	2a	2c
TAN Increase in oil layer	mg KOH/g	-	0.02	0.04	0.34
TAN Increase in water layer	mg KOH/g	4.0 max	0.5	not shown	1.39

Four Ball Wear Testing

Biosynthetic Technologies' estolides provide excellent wear protection. The estolide based hydraulic fluid performed in line with commercially available hydraulic fluids. In this formulation, estolides are able to offer wear protection due to their affinity for metal which allows them to stick to metal surfaces and provide a level of protection.



Shear Stability

Shear stability is important in hydraulic fluid performance to ensure consistent performance of the hydraulic fluid over time. Viscometric changes in the product will negatively impact the ability of the oil to function properly and provide the needed equipment protection.

	BT22	BT22 + Comm Adpack	Commercial EAL ISO 46	Commercial EAL ISO 68	Parker Denison, HF-1, HF-2, HF-6
20 hours	0.3%	0.45%	0.07%	0.83%	15% max

Bio Hydraulic Fluid

Biosynthetic Technologies formulated the first renewable and biodegradable hydraulic fluid that is formulated to meet Ecolabel Performance requirements. It is manufactured with our patented BT22 Base Oil and a commercially biodegradable additive package.

Formulation

BT22	39.68%
Group II/II+ Base Oil	59.40%
Additive	0.92%
Total	100.00%

The products superior performance can be viewed below.

Performance Data	Unit	ISO 46 EAL
Viscosity KV 100°C	cSt	8.43
Viscosity KV 40°C	cSt	46.0
Viscosity Index	-	162
Pour Point	C	-26
Flash Point (COC)	C	224
Total Acid Number	mg KOH/g	0.39
Color	-	<1
Gardner Color	-	5.5
Water Content	wt%	< 0.01
Rust Testing, A Fresh Water	-	Pass
Rust Testing, B Salt Water	-	Pass
Copper Corrosion	Rating	1a
Demulsibility	-	40, 40, 0 (15) - Pass
Foam	-	0/0, 0/0, 0/0
4-Ball Wear	mm	0.413
4-Ball Weld, Weld Load	kgf	160
4-Ball Weld, Last Non-Seizure Load	kgf	100
4-Ball Weld, Load-Wear Index	kgf	39.96
Hydrolytic Stability	-	-
Copper Weight Loss	mg/cm2	-0.058
Copper Appearance	Rating	2c shiny
TAN Increase in oil layer	mg KOH/g	0.24
TAN Increase in water layer	mg KOH/g	0.63
Oxidative Stability, RPVOT	min	584
Biodegradability	% in 28 days	75%
Ecotoxicity	-	-
Pseudokirchneriella subcapitata	-	Not acutely toxic
Daphnia magna	-	Not acutely toxic
Pimephales promelas	-	Not acutely toxic

Elastomer Compatibility

Biosynthetic Technologies' base oils are slightly polar and therefore usually slightly swell the seal. The Biosynthetic oil can be added to the formulation to help balance seal shrinkage and seal swell to develop a formulation that meets a target specification. Contact our technical department for specific elastomer compatibility data.

Formulation Assistance

Our lubricant specialists are well versed in our patented sustainable base oils as well as a variety of targeted performance additives engineered to provide ideal lubrication properties in countless applications. Our technical support staff is available to help with your formulation needs and assist you in achieving your target viscosity, biodegradability and renewability levels while remaining within your targeted price point.

Protect the environment

Biosynthetic® Technologies is committed to sustainability and clearly focused on the responsible use of natural resources in our daily business. We understand that health, environmental awareness and traceability play just as large a role for consumers as quality and efficacy. Biosynthetic® Technologies is aware of its responsibility in this business and sustainability. As such, our manufacturing facility is operating with a NEGATIVE carbon footprint! Take used oil and grease to an authorized collection point. Comply with local regulations. Do not discharge into drains, soil or water.

Health & Safety

This product is not likely to present any significant health or safety hazards when properly used in the recommended application and good standards of personal hygiene are maintained. Reference is made to the Safety Data Sheet (SDS).

Storage

We recommend storing all packages under cover. In case outside storage is unavoidable, drums should be laid horizontally to avoid the possible ingress of water and damage to drum markings. Products should never be stored above 60°C, exposed to hot sun or freezing conditions.

Legal disclaimer

Typical properties depicted on this document are average values only and do not constitute a specification. Minor variations that do not affect product performance are to be expected during normal manufacture, and at different blending locations. Product formulations are subject to change without notification.

**Pertains to Biosynthetic base oils and not the formulated product.*

Viscosity Blending Chart

	ISO 150	ISO 150	ISO 220	ISO 320	ISO 460	ISO 680
ISO VG 22 products KV @100 C – BT22	100%	-	-	-	-	-
ISO VG 150 products KV @100 C – BT75	-	60%	70%	80%	90%	100%
PAO 4	-	40%	30%	20%	10%	
Biodegradability	79%	73%	74%	75%	75%	76%
Renewable	84%	53%	63%	73%	84%	94%

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