



**BIOSYNTHETIC**<sup>®</sup>  
TECHNOLOGIES

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# GEAR OIL

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Biosynthetic<sup>®</sup> Technologies' revolutionary new class of biobased synthetic compounds called Estolides are made from organic fatty acids found in various bio-derived oils. These highly functional sustainable oils have numerous uses in lubricant, automotive, marine, and personal care applications and can be used as the primary base oil of a lubricant formulation, a component of a base oil co-blend, or even as an additive. In addition to their high-performance properties, these oils are Biodegradable, Sustainable, Renewable, Non-bioaccumulative, and Non-toxic.

To showcase the superior performance characteristics of these base oils, Biosynthetic Technologies formulated a high-performance synthetic gear oils used for industrial and marine applications. These uniquely patented base oils are compatible with conventional additive packages, allowing easy formulation of lubricants that will perform under extreme pressure and offer superior rust and oxidation characteristics and delivering excellent biodegradability. By replacing mineral oils or synthetic base stocks with Biosynthetic Technologies base oil, finished lubricants are improved to deliver superior operational performance, total cost of ownership and lower the overall environmental impact.

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.

## Industrial Gear Oil Sample Formulation

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

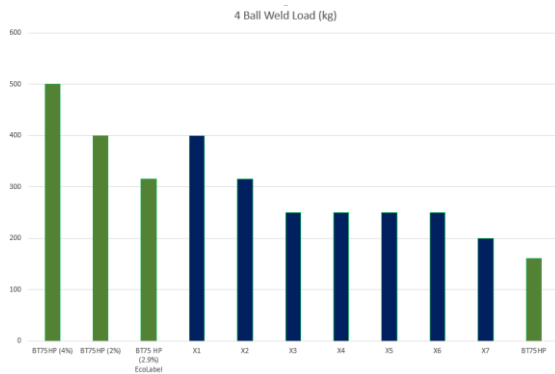
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These sample formulations have been created to assist our partners in formulating gear oils. However, they are not intended for commercialization.

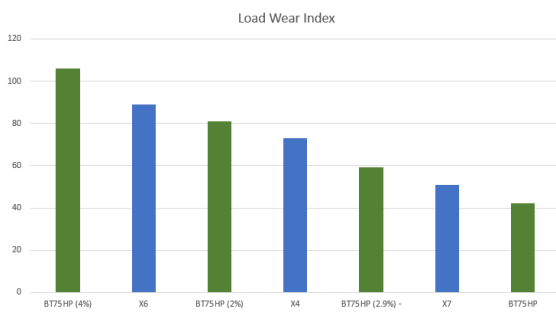
### Formulation Data

Biosynthetic Technologies has developed several gear oil formulation using its patented sustainable base oils BT22 (ISO VG 150) and BT75 (ISO VG 680) for the development of environmentally acceptable gear oils. For these formulations several commercially available additive packages were used at different treat rates; 4%, 2% and 2.9%. The finished gear oils were then tested against the leading gear oils in the industry as compared on performance characteristics such as load wear, load, and rust etc. The finished gear oils manufactured with the Biosynthetic Technologies sustainable base oils showed excellent performance capabilities for load wear, four ball weld and rust, among others. Both base oils (BT22 and BT75) offer formulators the ability to develop quality lubricants using high viscosity biobased oils. Even though BT22 and BT75 are much higher in viscosity than vegetable oils or many other environmentally friendly base oils they still have high bio-content and are biodegradable. In addition, both BT22 and BT75 blend well with common gear oil additive packages and have excellent load wear properties.

### Four Ball Weld Testing



### Load Wear Index



Ball 1

Ball 2

Ball 3



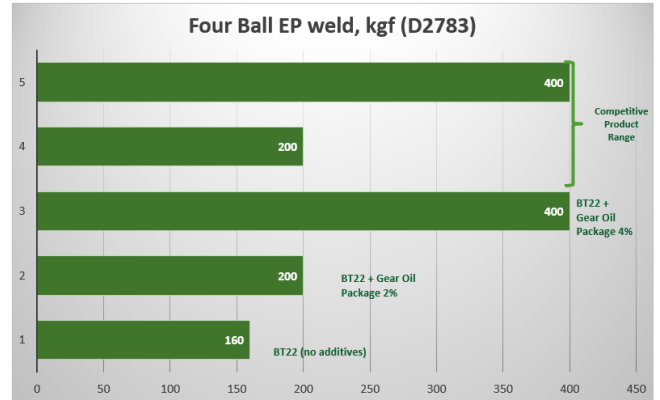
ASTM Method: D4172B: BT22 + Gear Oil Package 2% - Average Scar: **0.37**

### Applications

Ideal for use in a variety of gear oil applications and suitable for several 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 oils are compatible and miscible with mineral oil, eliminating complications that often occur with other environmentally friendly fluids.

### Four Ball Weld Testing



### Rust Testing

Rust testing is used to evaluate the hydraulic fluids ability to aid in preventing rusting of ferrous parts.

- With the right additive package Estolides are able to pass both fresh and saltwater rust testing
- When formulating, it's be important to evaluate the additive package to ensure the package used can pass rust testing.

BT22 with 1.25% Commercial Adpack



Fresh Water

Salt Water

Added Gear Oil

✓ BT22 + Gear Oil Package 2%



Unadded Gear Oil

✓ BT22



### Demulsibility

Demulsibility evaluates the hydraulic fluids ability to separate from water. To pass, the formulation must separate within the allotted timeframe. BT22 in a hydraulic fluid easily passes with results comparable to commercially available hydraulic fluids.

Property	Unit	BT22	BT22 + Comm Adpack	Commercial EAL ISO 32	Commercial EAL ISO 46	Commercial EAL ISO 68
Demulsibility	Minutes to separation	5	15	15	15	25

### 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

### Certifications and Registrations



### 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.

### 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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