



**ROYAL**  
**PURPLE**<sup>®</sup>  
SYNTHETIC OIL

INDUSTRIAL LUBRICATION

— G U I D E



# REDUCE THE COST OF MAINTENANCE BY REDUCING THE NEED FOR MAINTENANCE

# 54%

Lubrication-related failures account for 54% of all bearing failures.

Source: SKF USA Inc., also TAPPI 1995 Engineering Conference Proceedings

## CAUSES OF BEARING FAILURES

**34.4%**  
INADEQUATE LUBRICATION

**19.6%**  
CONTAMINATION

**18.6%**  
OTHER

**17.7%**  
INSTALLATION ERRORS

**6.9%**  
OVERLOAD

**2.8%**  
STORAGE AND HANDLING ERRORS



Failed bearings result in costly equipment maintenance and downtime. Most bearings fail because of improper lubrication.

Any serious effort to permanently reduce the cost of maintenance must include upgrading the quality of the lubrication.

**ROYAL PURPLE® IS THE SOLUTION!**

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## INTRODUCTION

The industrial and racing markets associate outstanding quality and superior performance with Royal Purple. This reputation has been earned through Royal Purple's relentless pursuit of excellence in lubrication.

Royal Purple formulates the most advanced lubricants available on the market today. If you currently use Royal Purple's products, you already know this. If you do not, they offer the opportunity to greatly improve the reliability and efficiency of your equipment and to lower your operating costs.

## SUPERIOR PRODUCTS, SUPERIOR PERFORMANCE

Lubricants are typically viewed as a commodity, where low price and service issues dominate purchase decisions. Therefore, oil companies seeking large market share have a great incentive to keep manufacturing costs low and little incentive to upgrade lubricant quality.

Royal Purple recognizes that lubricants are not a commodity. Reliable operation of rotating equipment critically depends upon the quality of the lubricant used. Lubricant performance directly and significantly affects how long, how reliable, how efficient and at what cost (i.e. parts, labor, downtime, number of oil changes and energy costs) your equipment will operate. Therefore, Royal Purple will always provide you with the highest quality lubricants available anywhere.

These products may be covered by one or more U.S. or foreign pending or issued patents. For details, visit [Calumet.com/patents](http://Calumet.com/patents).

## SYNERLEC® ADDITIVE TECHNOLOGY — BEYOND SYNTHETIC™

Synerlec additive technology is Royal Purple's most versatile additive technology and the cornerstone of its product line. Royal Purple's oils for turbines, pumps, compressors, blowers, hydraulics, gears, refrigeration systems, motor oils, and more contain Synerlec additive technology. It forms a tough, ionic, slippery, chemical film on all metal surfaces.

"Since our initial oil fill in November 1991 we have never had to change or drain your lubricating oil . . . which we monitor with an oil analysis program. Furthermore, we have not experienced a single bearing failure since plant start-up over 35,000 hours ago."

—Gas Plant Supervisor

"Our plant has more than 100 spindle bearings that exceed 7,200 rpm. Prior to using Royal Purple, the average bearing life was approximately four months. Since changing to the RP grease, there has been one bearing failure in over two years, and it was not lubrication related."

—Plant Maintenance Superintendent,  
Roofing Materials Manufacturer

## I. Synerlec Provides a Thicker Oil Film

By forming a chemical film on metal surfaces, Synerlec additive technology adds to the oil film thickness created by the oil viscosity alone. An increase in oil film thickness is proven to increase bearing life in direct proportion to the percentage increased. (See page 34 in technical appendix.)

## II. Synerlec Creates a Tougher Oil Film

The tough oil film on metal surfaces makes a breach of the oil film much more difficult and unlikely. By preventing metal-to-metal contact, Synerlec additive technology enables equipment to operate normally under severe operating conditions where it would otherwise quickly fail. Synerlec additive technology's ability to carry considerably greater loads than other mineral and synthetic oils provides extra protection for bearings subjected to mechanical stresses caused by misalignment, shaft flex, elevated temperatures, imbalance or water contamination, which thin the oil.

## III. Synerlec Micro-mend Contacting Metal Surfaces

When opposing asperities (microscopic projections on metal surfaces) breach the oil film of competitors' oils, surface initiated fatigue occurs, which causes bearing surfaces to quickly wear and become rougher. Vibrations steadily increase because these rough surfaces can no longer be fully separated by the thin film of the oil, causing increased metal-to-metal contact to occur. Synerlec additive technology's tough film strength not only makes it more difficult for asperities to breach the oil film, but it actually smooths bearing surfaces that have already been damaged. Instead of becoming rougher, Royal Purple's Synerlec additive technology gently micro-mends these asperities, creating smoother surfaces, which then are easily separated by Royal Purple's tough oil film. Damaged bearings experiencing high vibrations can run normally for greatly extended periods of time simply by changing to Royal Purple's oils with Synerlec additive technology. (See pages 34-35 in technical appendix.)

### ROYAL PURPLE LUBRICANTS ALLOWS PLANTS TO ACHIEVE SIGNIFICANT SAVINGS:

**0.1% energy savings exceed the total lubrication cost.** — Lubricant cost as a percentage of energy cost was 0.08%.

**3% maintenance savings would also exceed the lubrication cost.** — Lubricant cost as a percentage of maintenance cost was 2%.

If this plant were to achieve an energy savings of 2% and a maintenance savings of 30%, **it would produce an annual savings of approximately \$3.9 MILLION.**

## OTHER IMPORTANT ADVANTAGES

In addition to their superior ability to fully separate and lubricate metal surfaces, Royal Purple's lubricants offer these additional advantages:

### I. Longer Oil Life

Royal Purple's oils formulated with Synerlec additive technology last considerably longer than other mineral and synthetic oils. Synerlec additive technology protects against oil oxidation, which causes oils to break down, to thicken and to form corrosive acids, sludge, varnish or lacquer deposits in equipment. This greatly increases oil life, reducing the amount of oil purchased and disposed of. Equipment will remain cleaner and will have longer life.

### II. Excellent Corrosion Protection

Synerlec additive technology provides superior protection against rust and corrosion in both salt and freshwater environments. Royal Purple's Synerlec additive technology ionically bonds with all metal surfaces displacing moisture. Synerlec's tough film strength protects during operation, acts as a preservative oil during shutdown and provides instant lubrication upon startup until a full fluid oil film is established.

### III. Rapidly Separates from Water

Water in oil means death to bearings. Many oils form milky oil-water emulsions, which greatly shortens the life of both the oil and the equipment it lubricates. Royal Purple's synthetic lubricants rapidly and completely separate from water, allowing water to easily be drained from the bottom of the oil reservoir.

## IV. Additional Additive Technologies

In addition to Synerlec additive technology, Royal Purple formulates lubricants using the following three additional additive technologies:

**A. Synslide® additive technology** — This exclusive additive technology offers all of the performance advantages of Synerlec additive technology plus superior protection against boundary lubrication (lubrication between two rubbing surfaces without development of a full-fluid lubricating film) conditions typically caused by heavy loads, shock loads and slow operating speeds. Royal Purple's noncorrosive, extreme pressure (EP) gear oils and greases contain Synslide additive technology.

**B. DynaGlyde® additive technology** — Royal Purple's high film strength, noncorrosive DynaGlyde additive technology contains special anti-wear additives, oiliness properties and cushioning molecules to provide the lubricity necessary to excel in worm gear lubrication.

**C. Purolec® additive technology** — Royal Purple's NSF Certified oils for H1 service for use in pharmaceutical and food service plants contain Purolec additive technology. This proprietary, stable, anti-wear additive technology reduces wear yet still meets the FDA's CFR Title 21 Section 178.3620(b) purity regulation.

## V. Oil Cleanliness

Royal Purple's lubricants are packaged in new, clean steel drums and pails to ensure fluid cleanliness. Additionally, Royal Purple's best-selling bearing and hydraulic lubricants are filtered to a typical ISO 4406:99 cleanliness level of 14/13/11. (See pages 36–37 in technical appendix.) This is typically substantially cleaner than conventional lubricants delivered in steel drums or by bulk delivery. Bearing and hydraulic equipment manufacturers state this improvement in oil cleanliness will increase bearing and hydraulic component life from 300 to 500 percent. (See page 38 in technical appendix.) Royal Purple is the only lubricant manufacturer that has established these high cleanliness requirements for its standard products.

## VI. Saves Energy

Energy costs constitute the single largest expense of operating rotating equipment. The typical energy costs for rotating equipment are 20 to 25 times greater than direct maintenance costs. Royal Purple's premium, synthetic lubricants with Synerlec and Synslide additive technologies have extremely low coefficients of friction and are proven to save energy over other mineral and synthetic oils in rotating equipment. In fact, Royal Purple's lubricants frequently produce energy savings from 1 to 3 percent or more. In most instances, these savings exceed the total cost of the oil within several months, turning what was once an oil expense into a profit. Total elimination of lubrication expenses would not produce significant cost savings from the total operating costs of the rotating equipment. However, significant savings can be achieved through small percentage reductions in the large expense items — energy and maintenance costs. See example below.

**Actual Rotating Equipment Budget of a Large Petrochemical Plant**

Item	Annual Cost	Percent
Energy Cost	\$121,461,630	96.02%
Maintenance Cost	\$4,938,122	3.90%
Lubricant Cost	\$99,840	0.08%
Lube Cost as a % of Maint. Cost		2.00%
Lube Cost as a % of Energy Cost 0.08%		0.08%

Source | Heinz P. Bloch, P.E.

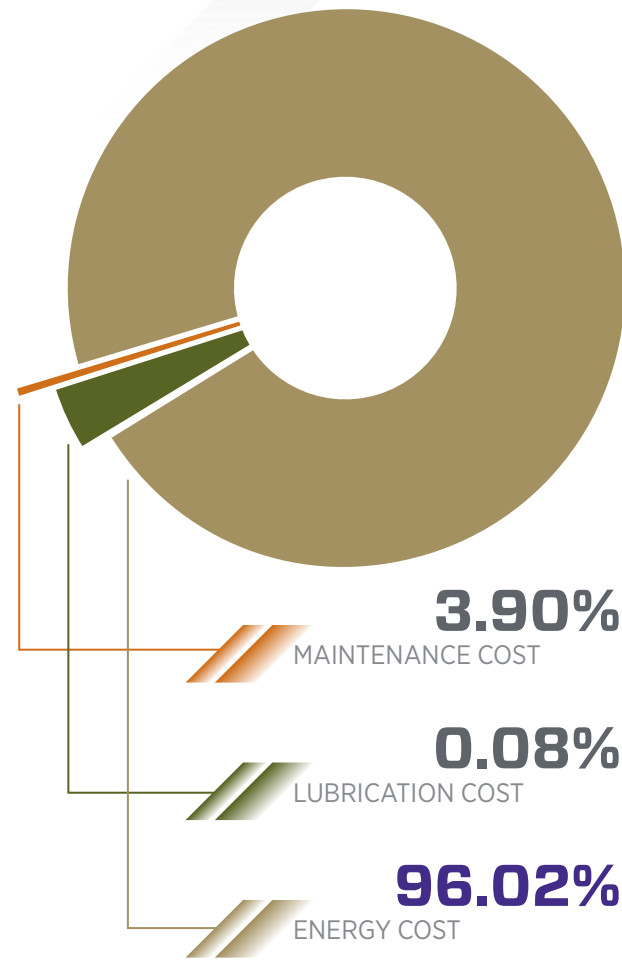
Item	Annual Cost	Percent
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Lube Cost as a % of Energy Cost		0.08%

Source | Heinz P. Bloch, P.E.

2% Energy Savings	\$2,429,232.60
30% Maintenance Savings	\$1,481,436.60
<b>Total Savings</b>	<b>\$3,910,669.20</b>

While the actual budget numbers as well as the potential savings from the use of Royal Purple's lubricants will vary from plant to plant, it is universally true that Royal Purple's lubricants will produce greatly leveraged savings from both the energy and maintenance budgets.

**The savings noted in the previous example are not an unrealistic expectation. Many plants have documented millions of dollars in savings per year after converting to Royal Purple's lubricants.**



**PURCHASE PRICE VS. VALUE**

What is the cost of oil? Some people may tell you it's the price you paid for it. They may even tell you how much money they've saved when they find a less expensive oil.

**But what is the real cost of the oil?**

But what is the real cost of the oil?

1. It's the purchase price.
2. It's the cost in service as represented by energy savings.
3. It's the cost of labor and replacement parts.
4. It's the cost of downtime and lost production.
5. It's the oil service life as represented by oil drain frequency.
6. It's the cost of used oil disposal.

**SUMMARY OF CUSTOMER BENEFITS**

**I. HIGH FILM STRENGTH**

Royal Purple's lubricants are considerably stronger than other synthetic oils.

- » Reduces wear and downtime
- » Improves equipment life and reliability
- » Lower operating temperatures
- » Reduces part replacement
- » Reduces bearing and equipment vibrations
- » Reduces maintenance costs

**II. LONGER OIL LIFE**

Royal Purple's lubricants last significantly longer than other synthetic oils.

- » Much less oil is purchased
- » Disposal costs are greatly reduced
- » Fewer oil changes save labor costs
- » Cleaner equipment

**III. OUTSTANDING CORROSION PROTECTION**

Royal Purple's lubricants provide greater protection than traditional circulating and EP oils.

- » Uniquely combines both high film strength and outstanding rust and corrosion protection into one oil.

**IV. EXCELLENT DEMULSIBILITY**

Royal Purple's lubricants do not emulsify with water, thereby saving equipment and oil changes by rapidly and completely separating from water.

- » Proprietary additive technologies protect in wet environments by displacing harmful water from metal surfaces.
- » Water is easily drained from bottom of oil reservoir.

**V. SAVES ENERGY**

Royal Purple's lubricants reduce energy costs.

- » Energy savings typically exceed the total cost of oil within a few months.

**VI. HIGH CLEANLINESS**

Royal Purple's bearing and hydraulic oils are substantially cleaner than conventional lubricants delivered in steel drums or by bulk delivery.

- » Always packaged in new, clean proprietary packaging.
- » Clean oil greatly improves the life of bearings and equipment.

"Using Synfilm in tests on nine pieces of equipment, average energy savings were 2.54 percent, which paid for the incremental cost of the more expensive oil in just 19 days."

—Maintenance Superintendent, Chemical Plant



**Actual testimonies from Royal Purple customers**

“In 1995, we had fifty-six documented mill motor trip outs due to over temperatures on motor bearings. During 1996 and now the 1997 season, we have had only one alarm and it was due to the high speed coupling tightening up from lack of grease.”  
 —Maintenance Superintendent, Chemical Plant

“Prior to making the switch, we experienced eight to ten gear box failures a year, at a cost of more than \$10,000 each. After converting to Royal Purple Synfilm GT 150, we have experienced only one failure in the past year.”  
 —Maintenance, Area specialists, Chemical Plant

“Recently I did a 16,000 hour inspection on two D-399 Caterpillar engines. I was completely surprised at the condition of the main bearings, camshaft and cylinders. There was virtually no wear found in the engines.”  
 —Assistant Superintendent, Oil Exploration Company

“I knew Royal Purple performed well when contaminated with water. . . . The Royal Purple protected the gears even though there was more seawater than Royal Purple at times.”  
 — Captain, Tugboat

“Over the past three years, these engines have accumulated in excess of 14,000 hours without an oil change.”  
 —Maintenance Superintendent, Offshore Drilling Contractor

“We had amazing results. We not only exceeded a 30 to 40°F temperature drop, but also noticed that there was less vibration in the unit.”  
 —Maintenance Superintendent, Offshore Drilling Contractor

“I am very pleased to report that after changing to Royal Purple Synfilm ISO 32, a dramatic decrease in downtime of approximately fifty percent has been experienced.”  
 —Supervisor, Gas Plant

“Royal Purple is proving each and every day to be the best lubrication in reciprocating compressors in services ranging from hydrogen to butane to isobutane.”  
 —Rotating Equipment Reliability Superintendent, Refinery

“This product works great in everything. In loaders alone, scheduled oil changes were every two hundred hours. With your product, we now . . . oil change every thousand hours.”  
 —Maintenance Supervisor, Fertilizer Plant

“Based on our data, using the synthetic oil Royal Purple in all lubricated equipment should provide a 4 percent to 8 percent reduction in electrical consumption. This reduction is valued between \$150,000 and \$220,000 a year.”  
 —Maintenance Superintendent, Refinery

*What is the Royal Purple Advantage?*  
**“Uncompromised Lubrication Performance”**

To read additional customer quotes or to view entire testimonies, visit [royalpurpleindustrial.com](http://royalpurpleindustrial.com).

*ROYAL PURPLE PRODUCTS*

All values reported are typical and may vary. Due to continual product research and development, the information contained herein is subject to change without notice. Additional product information is available by requesting product data sheets on individual products or by visiting Royal Purple’s website at [royalpurpleindustrial.com](http://royalpurpleindustrial.com).

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BioMax™ Hydraulic EAL	14
BioMax™ Multi-Purpose EP Gr 2	14
BioMax™ Stern Tube EAL	14
CAP™	15
Clean & Flush™	15
CMT™	15
Coupling Grease™	16
Crystal-Clear®	16
Crystal Pure®	16
DEZEL Hi-Base®	16
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HD Motor Oil	18
HP 2-C®	18
HP Straight Grade Motor Oil	18
HPS™	18
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Max-Chain®	20
Maxfilm®	20
Max-Gear®	20
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Quadrex®	22
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Synfilm®	24
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Synfilm® GT Wind Gear 320	25
Synfilm® NGL	25
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Thermasil™ T-100	26
Thermax™ 680 Grease	26
Thermyl-Glyde®	27
Thermyl-Glyde® Worm Gear Oil	27
Thermyl-Tuff™	28
Tuff Coat M	28
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USAGE	RECOMMENDED PRODUCT	PAGE
<b>INDUSTRIAL LUBRICANTS</b>		
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	NGL-NS	21
	Synfilm NGL	25
Compressor—Centrifugal Air	Synfilm GT	24
Compressor—Reciprocating Air	Synfilm Recip.	26
Compressor—Rotary Screw Air	Synfilm	24
Compressor—Vane Air	Synfilm GT	24
Cylinder Lubricant	CAP 700	15
	Thermyl-Glyde	27
Flushing Lubricant	Clean & Flush 46	15
Mechanical Seal Barrier Fluid	Barrier Fluid FDA	13
	Barrier Fluid GT	13
Penetrating Aerosol	Maxfilm	20
Pumps	Synfilm	24
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Rust Preventative	VP Preservative Oil 10	29
Spindle Lubricant	Synfilm GT	24
Steam Cylinder Lubricant	Thermyl-Glyde	27
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Wire Rope Lubricants	Wire Rope Lubricant	29
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**USAGE RECOMMENDED PRODUCT PAGE**

**GREASE**

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Bearings — <i>Multi-purpose</i>	Ultra-Performance Grease	<b>28</b>
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Compressors	Poly-Guard FDA	<b>22</b>
Gears	Poly-Guard FDA	<b>22</b>
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**AUTOMOTIVE LUBRICANTS**

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Differentials	Max-Gear	<b>20</b>
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Engine—4-Cycle Diesel	HD Motor Oil	<b>18</b>
Engine—Two Cycle Gasoline	HP 2-C	<b>18</b>
Transfer Cases 4 Wheel Drive	Max ATF	<b>20</b>
	Max-Gear	<b>20</b>
	HD Motor Oil	<b>18</b>
Transmissions—Automatic	Max ATF	<b>20</b>
Transmissions—Manual	Max-Gear	<b>20</b>
Transmissions—T-04 Spec	CMT	<b>15</b>
Wheel Bearings	Ultra-Performance Grease	<b>28</b>

**COMMERCIAL ENGINE OILS**

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Engine—4-Cycle Diesel	Motor Oil	<b>18</b>
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**ALKALUBE™** SYNTHETIC PUMP LUBRICANT FOR ALKALINE SERVICE (WITH SYNERLEC®)

Alkalube minimizes the effects of bases on the oil and caustic damage to metallic components, which greatly extends both the life of the oil and the pumps. Alkalube also contains Royal Purple's proprietary Synerlec additive technology, which is a high film strength, synthetic additive system that is proven to make equipment run smoother, cooler, quieter, longer and more efficiently. Alkalube is recommended for lubricating compressors in alkaline environments. Alkalube is an undyed product.

PRODUCT	cSt @40°C	cSt @100°C	VI	Flash Point °F / °C	Pour Point °F / °C	ISO Grade
Alkalube 32	32	6.1	140	460 / 238	-38 / -39	32

**BARRIER FLUID® FDA** BUFFER/BARRIER FLUID FOR DOUBLE, DUAL & TANDEM MECHANICAL SEALS

Barrier Fluid FDA is a pure, non-reactive, synthetic fluid that provides superior lubrication and cooling for double and tandem mechanical seals. Barrier Fluid FDA provides very stable seal performance over an extremely wide temperature range, satisfying most seal service requirements. Barrier Fluid FDA is extremely clean and has excellent low temperature fluidity and heat transfer properties. Barrier Fluid FDA is sanctioned under the FDA CFR Title 21 Sections 178.3620(a)(b); 172.878; 175.105; 176.200 and 210; 177.2260, 2600 and 2800; 178.3570 and 3910. It is NSF Certified for H1 service. Barrier Fluid FDA is essentially inert, allowing it to be used with most hydrocarbon gases and aqueous acids and bases. Barrier Fluid FDA is an undyed product.

PRODUCT	cSt @40°C	cSt @100°C	VI	Flash Point °F / °C	Initial Boiling Point °F / °C	Pour Point °F / °C	ISO 4406*
Barrier Fluid FDA 22**	5.2	1.7	—	330 / 166	567 / 297	-70 / -57	14 / 13 / 11
Barrier Fluid FDA 34**	17	3.9	123	445 / 229	637 / 336	-85 / -65	14 / 13 / 11
Barrier Fluid FDA 56**	31	5.8	135	465 / 241	720 / 382	-39 / -39	14 / 13 / 11
Barrier Fluid FDA 78**	47	7.8	136	505 / 263	847 / 453	-31 / -35	14 / 13 / 11
Barrier Fluid FDA 910	66	9.9	135	530 / 277	810 / 432	-65 / -54	14 / 13 / 11

\* Check with manufacturer regarding availability with 14/13/11 cleanliness. \*\* NSF Certified H1.

**BARRIER FLUID® GT** BUFFER/BARRIER FLUID FOR DOUBLE, DUAL & TANDEM MECHANICAL SEALS

Barrier Fluid FDA is a pure, non-reactive, synthetic fluid that provides superior lubrication and cooling for double and tandem mechanical seals. Barrier Fluid FDA provides very stable seal performance over an extremely wide temperature range, satisfying most seal service requirements. Barrier Fluid FDA is extremely clean and has excellent low temperature fluidity and heat transfer properties. Barrier Fluid GT is recommended for use at elevated temperatures where a nitrogen purge is not an option and when FDA purity is not required. Barrier Fluid GT has similar physical properties to Barrier Fluid FDA plus additional oxidation stability. Barrier Fluid GT is an undyed product.

PRODUCT	cSt @40°C	cSt @100°C	VI	Flash Point °F / °C	Initial Boiling Point °F / °C	Pour Point °F / °C	ISO 4406*
Barrier Fluid GT 22	5.2	1.7	—	330 / 166	567 / 297	-70 / -57	14 / 13 / 11
Barrier Fluid GT 34	17	3.9	123	445 / 229	637 / 336	-85 / -65	14 / 13 / 11
Barrier Fluid GT 56	31	5.8	135	465 / 241	720 / 382	-39 / -39	14 / 13 / 11
Barrier Fluid GT 78	47	7.8	136	505 / 263	847 / 453	-31 / -35	14 / 13 / 11
Barrier Fluid GT 910	66	9.9	135	530 / 278	810 / 432	-65 / -54	14 / 13 / 11

\* Check with manufacturer regarding availability with 14/13/11 cleanliness.



**BIOMAX™ GEAR EAL** ENVIRONMENTALLY ACCEPTABLE GEAR OIL (WITH SYNERLEC®)

BioMax Gear EAL is environmentally acceptable, high performance lubricants formulated for those users of gear oil products in marine applications affected by the 2013 Vessel General Permit (VGP). As an Environmentally Acceptable Lubricant (EAL), BioMax is Readily Biodegradable, exhibits extremely low aquatic toxicity, and is non-bioaccumulative. BioMax EAL Gear Oil provides excellent performance in severe marine applications such as thrust gears, steering gears, stern tube and other marine gear functions. The long life and high film strength of BioMax EAL Gear Oil greatly increases equipment reliability as well as provides excellent protection in highly corrosive environments. It gains its performance advantage over competing oils through its superior blend of base oils plus Royal Purple's proprietary Synerlec® additive technology. This unique, synthetic additive technology is proven to make bearings and equipment run smoother, cooler, quieter, longer and more efficiently. BioMax EAL Gear Oil carries the EU Ecolabel.

PRODUCT	cSt @40°C	cSt @100°C	VI	Flash Point °F / °C	Pour Point °F / °C	4-Ball Weld Load, kgf	Biodegradability
BioMax EAL Gear Oil 100	100	14.4	146	435 / 224	-38 / -39	315	> 60%
BioMax EAL Gear Oil 150	150	19.7	149	468 / 242	-33 / -36	315	> 60%
BioMax EAL Gear Oil 220	220	26.3	152	469 / 243	-33 / -36	315	> 60%
BioMax EAL Gear Oil 320	320	34.8	153	489 / 254	-27 / -33	315	> 60%
BioMax EAL Gear Oil 460	460	46.1	156	500 / 260	-27 / -33	315	> 60%
BioMax EAL Gear Oil 680	680	61.6	159	513 / 267	-22 / -30	315	> 60%

**BIOMAX™ HYDRAULIC EAL** ENVIRONMENTALLY ACCEPTABLE HYDRAULIC OIL (WITH SYNERLEC®)

BioMax Hydraulic EAL is environmentally acceptable, high performance lubricants formulated for those users of hydraulic oil products in marine applications affected by the 2013 Vessel General Permit (VGP). As an Environmentally Acceptable Lubricant (EAL), BioMax is Readily Biodegradable, exhibits extremely low aquatic toxicity, and is non-bioaccumulative. BioMax EAL Hydraulic Oil provides outstanding performance in marine hydraulic systems, both subsea and on-deck. The long life and high film strength of BioMax EAL Hydraulic Oil greatly increases equipment reliability as well as provides excellent protection in highly corrosive environments. It gains its performance advantage over competing oils through its superior blend of base oils plus Royal Purple's proprietary Synerlec® additive technology. This unique, synthetic additive technology is proven to make bearings and equipment run smoother, cooler, quieter, longer and more efficiently. BioMax EAL Hydraulic Oil carries the EU Ecolabel.

PRODUCT	cSt @40°C	cSt @100°C	VI	Flash Point °F / °C	Pour Point °F / °C	Biodegradability
BioMax EAL Hydraulic Oil 22	22	4.9	158	475 / 246	-81 / -63	> 60%
BioMax EAL Hydraulic Oil 32	32	6.2	159	451 / 233	-76 / -60	> 60%
BioMax EAL Hydraulic Oil 46	46	8.1	159	451 / 233	-76 / -60	> 60%
BioMax EAL Hydraulic Oil 68	68	10.7	159	448 / 231	-49 / -45	> 60%

**BIOMAX™ MULTI-PURPOSE EP GREASE 2** ENVIRONMENTALLY ACCEPTABLE GREASE

BioMax calcium sulphonate grease, made from a novel, biodegradable, renewable, non-toxic, non-bioaccumulative, synthetic thickener, is formulated for equipment operating in environmentally sensitive areas, and where incidental food contact may occur, as well as other industry applications. This patentable technology provides high-performance, uncompromised protection for greased machinery while meeting environmental standards. BioMax Multi-Purpose EP Grease delivers exceptional extreme pressure protection and anti-wear properties, high thermal and oxidative stability, and a wide operating temperature range. BioMax grease also provides excellent rust and corrosion protection, and resistance to water displacement and spray-off. This is especially critical in harsh marine environments where equipment is exposed to wet and highly corrosive conditions. BioMax Multi-Purpose EP Grease 2 is EU Ecolabel, NSF H-1, Kosher and Halal certified. It meets US EPA VGP and 2018 VIDA, and contains no MOSH and no MOAH.

PRODUCT	Base Oil, cSt @40°C	Base Oil, cSt @100°C	Drop Point °F / °C	NLGI Grade	Worked Cone Penetration	4-Ball Weld Load, kgf
BioMax Multi-Purpose EP Grease 2	103	16.4	>300 / >572	2	265	620

**BIOMAX™ STERN TUBE EAL** ENVIRONMENTALLY ACCEPTABLE STERN TUBE LUBRICANT

BioMax Stern Tube EAL is an environmentally acceptable, synthetic, high performance lubricant formulated for stern tube lubrications in marine applications. As an Environmentally Acceptable Lubricant (EAL), BioMax is Readily Biodegradable, exhibits extremely low aquatic toxicity, and is non-bioaccumulative. This product is European Ecolabel approved, meets the US EPA 2013 Vessel General Permit (VGP) guidelines as an Environmentally Acceptable Lubricant (EAL). BioMax Stern Tube Oils are biodegradable, non-emulsifying, non-bioaccumulative, minimally toxicity, provides excellent seals compatibility in preventing leakage, protection for bearings, propeller shaft and stern tube systems at varying operating temperature conditions. The long life and noncorrosive BioMax Stern Tube Oil greatly increase reliability, efficiency as well as exceptional thermal and oxidative stability at high temperatures in highly corrosive environments. It gains its performance advantage over competing oils through its superior blend of renewable synthetic base oils plus Royal Purple's proprietary Synerlec® additive technology. This unique, synthetic additive technology is proven to prevent bearing failures, corrosion, rust, reduce equipment downtime, provides longevity and energy savings.

PRODUCT	cSt @40°C	cSt @100°C	VI	Flash Point °F / °C	Pour Point °F / °C	Biodegradability
BioMax Stern Tube EAL 100	100	15.2	158	506 / 263	-38 / -39	> 60%
BioMax Stern Tube EAL 150	150	20.6	159	512 / 267	-38 / -39	> 60%

**CAP™** CYLINDER AND PACKING GLAND LUBRICANT (WITH SYNERLEC®)

CAP is a synthetic, compressor lubricant that forms a tacky, tenacious and tough oil film on both metal and ceramic surfaces. It is extremely shear stable, water resistant and impermeable to water vapor and hydrocarbon gases. CAP minimizes wear in high pressure compressors and is commonly used in gas reinjection compressors. CAP is recommended for use in gas, reciprocating compressors such as hydrogen, nitrogen, ethylene, carbon dioxide, methane, ethane, butane, propane, propylene, helium, LPG, etc. Cap is commonly used in gas reinjection compressors.

PRODUCT	cSt @40°C	cSt @100°C	VI	Flash Point °F / °C	Pour Point °F / °C	ISO Grade
CAP 700/460	460	29.0	124	430 / 221	-44 / -42	460

**CLEAN & FLUSH™** OIL CIRCULATION SYSTEM CLEANER

Clean & Flush can be used in three ways: First, Clean & Flush can be added to an existing oil to clean varnish and sludge from equipment prior to draining the existing oil. Second, Clean & Flush can be used as a temporary oil fill to clean varnish and sludge from equipment before refilling with new Royal Purple oil. And third, Clean & Flush can be used as a temporary oil fill for cleaning and flushing a polyglycol oil that is incompatible with the new oil to be used (i.e. when changing from a polyglycol oil to a Royal Purple PAO or para-synthetic oil. Royal Purple's Clean & Flush is a safe, effective and inexpensive product for cleaning sludge and varnish from equipment while in service. Clean & Flush is an undyed product.

PRODUCT	cSt @40°C	cSt @100°C	VI	Flash Point °F / °C	Pour Point °F / °C
Clean & Flush	46	6.3	79	470 / 243	0 / -18

**CMT™** MANUAL TRANSMISSION FLUID

Royal Purple CMT contains a blend of premium mineral and synthetic lubricants, which provide greater oxidation protection, low temperature fluidity and shock loading protection than conventional oils. This promotes greater oil life, smoother brake operation, reduced gear wear, controlled powershift transmission friction and more reliable equipment operation. Royal Purple CMT oil meets the requirements for Caterpillar TO-4; Allison C-4, CF-2 and CF; Eaton; and Dana manual transmissions. Recommended for MT-1 applications and caterpillar powershift.

PRODUCT	cSt @40°C	cSt @100°C	VI	Flash Point °F / °C	Pour Point °F / °C	SAE Grade
CMT 30	95	11.7	108	465	-38 / -39	30
CMT 50	169	16.7	104	475	-27 / -33	50

**COUPLING GREASE™** SYNTHETIC COUPLING GREASE (WITH SYNSLIDE®)

Royal Purple's Coupling Grease is a lithium complex, high film strength grease that provides superior resistance to oil separation from the high centrifugal forces generated by couplings. It is formulated with high viscosity synthetic oils and tacky, synthetic polymers, plus Royal Purple's proprietary Synslide additive technology to provide the tenacity and film strength necessary to protect against heavy loads and high centrifugal forces.

PRODUCT	Base Oil cSt @40°C	Base Oil cSt @100°C	NLGI Grade	Drop Point °F / °C	Cone Penetration, mm	4-Ball Weld Load, kgf
Coupling Grease	2995	112	1	442 / 228	329	400

**CRYSTAL-CLEAR®** SYNTHETIC WHITE OIL (UNDYED PRODUCT)

Crystal-Clear is a pure, nonreactive lubricant that has excellent anti-wear properties. It provides very good protection against rust and corrosion yet will not poison catalysts downstream of the compressor. Crystal-Clear resists dilution from hydrocarbon gases, effectively preventing both compressor and packing gland wear. It is a superior lubricant for hydrogen, hydrogen chloride, sulfur dioxide, nitrogen, carbon monoxide, carbon dioxide and helium compressors. It also excels in the lubrication of hyper compressors and hydrocarbon gas compressors such as ethylene, methane, ethane, butane, propane, acetylene, propylene, helium, LPG, etc. Crystal-Clear meets all of the requirements of a white mineral oil but has the superior lubrication of a synthetic oil. Crystal-Clear high viscosity index, thermal stability, low coefficient of friction and high specific heat index enable it to outperform white mineral oils over an extremely wide temperature range. Crystal-Clear is recommended for lubricating gas compressors where the oil may come into contact with catalysts downstream of the compressor. Crystal-Clear is an undyed product.

PRODUCT	cSt @40°C	cSt @100°C	VI	Flash Point °F / °C	Pour Point °F / °C	ISO Grade
Crystal-Clear 40X	96	14.1	150	510 / 266	-44 / -42	100

**CRYSTAL PURE®** SYNTHETIC X GRADE COMPRESSOR LUBRICANT

Crystal Pure "X" Grade lubricants are pure, inert, ash-less, and non-reactive making them an excellent choice for hyper compressors, and high/low pressure process gas compressors. Crystal-Pure lubricants are insoluble in most process gases, resist dilution by process gases, and are non-poisonous to process catalysts. This provides a lubricants that has extended useful life, and that extends the life of cylinders, rings and packing. Crystal-Pure can be used in compressor services requiring compliance with FDA regulations Title 21, CFR 121.2511; CFR 177.1430; CFR 178.3570; and CFR 178.3910. 1X, 2X grades meet Ingersoll-Rand viscosity requirements; 40X, 60X grades meet Cooper-Bessemer viscosity requirements.

PRODUCT	cSt @40°C†	cSt @100°C†	Pour Point °F / °C	ISO Grade†
Crystal Pure 1X	79	12.3	-50 / -45	68
Crystal Pure 2X	118	15.1	-45 / -42	100
Crystal Pure 40X	177	17.6	-40 / -40	150
Crystal Pure 60X*	377	29.0	-35 / -37	320

† Approximate viscosity in centistokes and ISO grade, based on SSU viscosity measurements. \* Crystal Pure 60X is NSF certified H1 food grade purity

**DEZEL HI-BASE®** HIGH SULFUR FUEL DIESEL ENGINE OIL (WITH SYNERLEC®)

Dezel Hi-Base is a synthetic blend engine oil recommended for diesel engines operating on high sulfur fuels sometimes used in South America, Africa, Asia and Mexico. The high sulfur content of the fuel requires the use of engine oils with higher alkalinity (higher TBN) to neutralize the increased acidity caused by the fuel. Generally, the required base number (TBN) of the engine oil is 20 times the sulfur content of the fuel. Dezel Hi-Base is also formulated with Royal Purple's proprietary Synerlec additive so it provides superior film strength and wear protection along with the increased acid neutralization benefits. For sale and use only outside of the US and Canada.

PRODUCT	cSt @40°C	cSt @100°C	VI	Flash Point °F / °C	TBN	Sulfated Ash % Weight	SAE Grade
Dezel Hi-Base 15W-40	106	14.4	140	420 / 216	12	>1	15W-40

**DURALEC® SUPER MOTOR OIL** HIGH PERFORMANCE SYNTHETIC DIESEL ENGINE OIL

Royal Purple Duralec Super motor oil is a high performance engine oil made for emission-controlled diesel engines utilizing emissions equipment such as: DPF's, Catalytic Converters, EGR, and SCR injection. Royal Purple Duralec Super 10W-30 and 15W-40 are API CK-4 engine oils. Royal Purple Duralec Super motor oil is specifically formulated to maximize component life, extend drain intervals and improve fuel performance. These premium lubricant formulations provide excellent high temperature resistance and low temperature pumpability, outstanding soot dispersancy, improved rust and corrosion protection, and prevention of varnish and sludge formation.

PRODUCT	cSt @40°C	cSt @100°C	VI	Flash Point °F / °C	TBN	Sulfated Ash % Weight	SAE Grade	API Service
DURALEC SUPER MOTOR OIL 5W-40	93.3	15.2	172	435 / 224	10.1	1	5W-40	CK-4, CJ-4, CI-4+
DURALEC SUPER MOTOR OIL 10W-30	81.9	12.1	144	434 / 223	9.3	.99	10W-30	CK-4, CJ-4, CI-4+
DURALEC SUPER MOTOR OIL 15W-40	108	15.2	146	454 / 234	10	.98	15W-40	CK-4, CJ-4, CI-4+

**ENDURO-MP GREASE** MULTI-PURPOSE EXTREME PRESSURE GREASE

Enduro-MP Grease is high performance, multi-service, calcium sulfonate complex grease. Its outstanding performance is achieved through a blend of high-quality base oils and additives, plus Royal Purple's unique, proprietary Synslide® additive technology. The superior Royal Purple grease formulation combined with a premium calcium sulfonate thickener provides unsurpassed protection against friction, wear and corrosion, and is inherently water resistant. Enduro-MP Grease significantly increases bearing life and equipment reliability, allowing bearings to run smoother, cooler, quieter, longer and more efficiently. Enduro-MP Grease satisfies a wide range of grease requirements and is recommended for bearings and general purpose use.

PRODUCT	Base Oil, cSt @40°C	Base Oil, cSt @100°C	Drop Point °F / °C	NLGI Grade	Worked Cone Penetration	4-Ball Weld Load, kfg
Enduro-MP Grease	136	10.9	641 / 338	2	265	620

**ESCALATOR CHAIN LUBE** SYNTHETIC ESCALATOR CHAIN LUBRICANT

Escalator Chain Lube significantly improves equipment reliability while greatly reducing lubricant consumption. Escalator Chain Lube reduces noise levels and extends the life of chains and other high wear components such as novatex boards. Escalator Chain Lube is an ultra-tough, high-film strength synthetic lubricant designed to lubricate the chains of escalators, moving sidewalks and elevator doors.

PRODUCT	cSt @40°C	cSt @100°C	VI	Rubber Railing Swell 30 Days @ 95°C	Pour Point °F / °C	Flash Point °F / °C
Escalator Chain Lube	47	7.7	132	3%	-38 / -39	440 / 227

## HD MOTOR OIL HIGH PERFORMANCE ENGINE OIL (WITH SYNERLEC®)

Royal Purple® HD Motor Oil is specifically formulated to maximize performance and meet the demands of heavy-duty diesel engines. Many older heavy-duty engines, and some newer commercial and stationary engines recommend the use of heavy-duty engine oil with a high level of anti-wear additive (ZDDP), and heavier viscosity grades. HD Motor Oil is fortified with a high level of zinc/phosphorus anti-wear additive and a generous dose Synerlec®. Synerlec is Royal Purple's proprietary additive chemistry that greatly increases the protective film strength of the oil, reducing metal to metal contact, friction and wear.

PRODUCT	cSt @40°C	cSt @100°C	VI	Flash Point °F / °C	Total Base No.	API Service	SAE Grade
SAE 15W-40 HD	101.13	14.7	151	450 / 232	9.6	CK-4, CJ-4, CI-4 +	15W-40

## HP 2-C® 2-CYCLE GASOLINE ENGINE OIL (WITH SYNERLEC®)

HP 2-C is a high performance engine oil that improves performance and reduces wear in both standard and high performance 2-cycle gasoline engines. HP 2-C synthetic solvency keeps spark plugs and exhaust ports clean for maximum engine efficiency. This engine cleanliness combined with HP 2-C's low coefficient of friction promotes increased horsepower and engine speed. Engines operate with greater combustion efficiency and go longer between overhauls when lubricated with HP 2-C. HP 2-C is recommended for use in both pre-mixed and injected gasoline 2-cycle engines.

PRODUCT	cSt @40°C	cSt @100°C	VI	Flash Point °F / °C	Pour Point °F / °C
HP 2-C	40	6.8	130	230 / 110	-49 / -45

## HP STRAIGHT GRADE MOTOR OIL HIGH PERFORMANCE ENGINE OIL (WITH SYNERLEC®)

Royal Purple® HP Straight Grade Motor Oil is specifically formulated for vintage automotive, off-highway agricultural and recreational, and older non-turbo diesel engines. Many older gasoline and diesel engine recommend the use of a straight (mono-viscosity) grade engine oil, and these engines also benefit from elevated wear-protecting chemistry, beyond what is allowed in current engine oil specifications intended for late-model, emissions-controlled vehicles. Royal Purple HP Straight Grade engine oils provide enhanced protection against wear and friction with a zinc/phosphorus enhanced formulation, and Royal Purple's proprietary additive technology, Synerlec®.

PRODUCT	cSt @40°C	cSt @100°C	VI	Flash Point °F / °C	Total Base No.	API Service	SAE Grade
SAE 30	7.3	10.1	116	440 / 226	9.5	CK-4/SN	30
SAE 40	124	13.8	109	450 / 232	9.8	CK-4/SN	40
SAE 50	185	18.6	112	454 / 234	9.4	CK-4/SN	50

## HPS™ HIGH PERFORMANCE ENGINE OIL (WITH SYNERLEC®)

HPS (High Performance Street Motor Oil) is a long life, high film strength engine oil that greatly exceeds the performance of other premium mineral and synthetic oils. HPS is fortified with a high level of zinc/phosphorus anti-wear additive and Royal Purple's proprietary Synerlec additive technology. HPS Series of motor oil responds to increased pressure with increased viscosity. It's advanced additive technologies improve the condition of metal-to-metal contact under severe conditions for greater protection. All viscosities of HPS, excluding 5W-20, are formulated for use in gas and/or diesel engines. HPS is recommended for use in gasoline and diesel automotive, commercial fleet and stationary industrial engines.

PRODUCT	cSt @40°C	cSt @100°C	VI	Flash Point °F / °C	Total Base No.	SAE Grade
HPS SAE 5W-20	51	8.9	157	385 / 196	10	5W-20
HPS SAE 5W-30	66	11.3	167	385 / 196	10	5W-30
HPS SAE 10W-30	71	11.3	151	365 / 185	10	10W-30
HPS SAE 10W-40	92	13.7	151	385 / 196	10	10W-40
HPS SAE 20W-50	177	20.1	134	390 / 199	10	20W-50

## HY-THERM™ 707 SYNTHETIC HEAT TRANSFER OIL

Hy-Therm 707 is a synthetic heat transfer oil that is more efficient than mineral oil based fluids. Its thermal conductivity (0.121 BTU/hr ft °F at 400°F) is 50% to 100% higher than many widely used heat transfer fluids. This means that heat energy is absorbed and released by Hy-Therm much more quickly than typical mineral heat transfer fluids. Hy-Therm 707 also has a significantly higher heat capacitance than typical mineral heat transfer fluids. In open systems, Hy-Therm can safely be used at operating temperatures up to 400°F. Closed systems with inert gas (e.g. nitrogen) blanketing can safely operate with Hy-Therm 707 up to 700°F. Hy-Therm 707 is an undyed product.

PRODUCT	cSt @40°C	cSt @100°C	VI	Flash Point °F / °C	Fire Point °F / °C	Pour Point °F / °C	Specific Gravity
Hy-Therm 707	34	6.1	128	450 / 232	505 / 262	-60 / -51	0.83

## MARINE HYDRAULIC OIL SYNTHETIC BLEND HYDRAULIC OIL (WITH SYNERLEC®)

Marine Hydraulic Oil meets the U.S. Fish and Wildlife Department's and the EPA's toxicity test requirements for marine life. Marine Hydraulic Oil is an excellent, high performance, hydraulic oil for use in sensitive environments such as off-shore platforms and other marine related services. The long life and high film strength of Marine Hydraulic Oil greatly increases equipment reliability and provides excellent protection in highly corrosive environments. It gains its performance advantage over competing oils through its superior blend of base oils plus Royal Purple's proprietary Synerlec additive technology. This unique, synthetic additive technology is proven to make bearings and equipment run smoother, cooler, quieter, longer and more efficiently. Marine Hydraulic Oil is a high performance, inherently biodegradable, environmentally responsible and ashless formula that protects equipment and the environment.

PRODUCT	cSt @40°C	cSt @100°C	VI	Flash Point °F / °C	Pour Point °F / °C	ISO Grade
Marine Hydraulic Oil 15*	15	3.3	98	360 / 182	-44 / -42	15
Marine Hydraulic Oil 22*	22	4.4	100	425 / 218	-54 / -48	22
Marine Hydraulic Oil 32	32	5.4	104	415 / 213	-38 / -39	32
Marine Hydraulic Oil 46	46	6.8	101	445 / 230	-35 / -37	46
Marine Hydraulic Oil 68	68	8.7	100	475 / 246	-27 / -33	68

\*Special Order Product.



**MAX ATF®** AUTOMATIC TRANSMISSION FLUID

Max ATF synthetic, automatic transmission fluid is a high performance, long life, multi-purpose transmission fluid. Max ATF is more oxidation stable than other transmission fluids and greatly resists breakdown from heat and loss of proper lubricity. Max ATF is a premium synthetic, multi-spec automatic transmission fluid.

PRODUCT	cSt @40°C	cSt @100°C	VI	Flash Point °F / °C	Pour Point °F / °C
Max ATF	36	7.3	177	420 / 216	-76 / -60

**MAX-CHAIN®** DRY FILM/EP LUBRICANT (WITH SYNERLEC)

Max-Chain is an advanced, high performance, synthetic lubricant that provides excellent protection for chains, open gears and exposed metal surfaces subjected to severe loading — even in wet, acidic environments. Max-Chain is a unique, thixotropic lubricant blended with a solvent carrier. It can be easily applied by either spraying or brushing. Once applied the carrier film evaporates, leaving a tenacious, dry, wax-like film. This non-tacky film effectively minimizes the collection of abrasive dust and other airborne contaminants. Its dry lubricant film performance is enhanced with EP properties to greatly reduce wear and to effectively extend equipment life. Max-Chain can lubricate up to 400°F (after carrying solvent has evaporated) and provides excellent protection against rust and corrosion. Max-Chain is an undyed product. Note: Caution — Consult manufacturer for high temperature applications. Max-Chain is recommended for chains and open gears operating in dusty environments.

PRODUCT	cSt @40°C	cSt @100°C	Aerosol Flash °F / °C	Flash Point °F / °C
Max-Chain	3.8	1.4	200 / 93	205 / 96

**MAXFILM®** MULTIPURPOSE LUBRICANT/PENETRANT/PRESERVATIVE (WITH SYNERLEC)

Maxfilm is a high film strength, multipurpose, synthetic lubricant/penetrant that excels in plantwide maintenance-related applications. Maxfilm deeply penetrates, cleans and loosens rusted parts and provides long-lasting lubrication and protection against rust and corrosion. Its high film strength facilitates ease of drilling or tapping of both steel and aluminum. Maxfilm is an undyed product.

PRODUCT	cSt @40°C	cSt @100°C	Aerosol Flash °F / °C	Flash Point °F / °C
Maxfilm	5.6	1.8	215 / 102	215 / 102

**MAX-GEAR®** HIGH PERFORMANCE GEAR OIL (WITH SYNERLEC)

Max-Gear is a high performance automotive gear oil designed to provide maximum protection to heavily loaded gears while increasing power throughput through the drive train. Max-Gear virtually eliminates both gear and bearing wear—even under severe squeeze film conditions caused by extremely high loads, sudden shock loads or low RPMs. Slippery, synthetic molecules not only reduce wear and friction but significantly increase Max-Gear's cold weather fluidity and lubricity, making it the ideal choice for vehicles operating in cold climates. Gears run smoother, quieter, cooler and longer without overhauls. It is noncorrosive to both ferrous and nonferrous metals. Max-Gear is recommended for truck and automotive differentials, outboard motor lower units or in rear axles or manual transmissions requiring an API fluid.

PRODUCT	cSt @40°C	cSt @100°C	VI	Flash Point °F / °C	Pour Point °F / °C	Timken OK Load	SAE Grade
Max-Gear SAE 75W-90	111	16.9	166	375 / 191	-54 / -48	72	75W-90
Max-Gear SAE 75W-140	192	27.9	188	350 / 177	-65 / -54	80	75W-140
Max-Gear SAE 80W-90	157	17.4	121	385 / 197	-38 / -39	62	80W-90
Max-Gear SAE 85W-140	284	26.8	126	375 / 191	-33 / -37	71	85W-140

**MAX-TUFF™** ASSEMBLY LUBE (WITH SYNSLIDE)

Max-Tuff is an ultra-tough, synthetic lubricant designed for use in reassembling repaired equipment. Max-Tuff utilizes unique, synthetic molecules that adhere tenaciously to metal surfaces to create a formidable, load-bearing physical barrier between surfaces. This minimizes the possibility of boundary conditions (metal-to-metal contact) while providing excellent protection to both ferrous and nonferrous metals against rust and corrosion.

PRODUCT	cSt @40°C	cSt @100°C	VI	Flash Point °F / °C
Max-Tuff	650	47.8	125	300 / 149

**NGL-NS™** HYDROCARBON GAS COMPRESSOR OIL

NGL-NS is virtually sulfur free and is formulated with dense, closely packed, synthetic molecules to greatly resist dilution from compressed hydrocarbon gases. It is also extremely hydrophobic and rapidly separates from water, which protects bearings and other components from rust and corrosion. NGL-NS makes gas compressors run longer with minimum wear. NGL-NS is an undyed product. NGL-NS is a premium, synthetic lubricant specifically designed to increase the service life of reciprocating gas compressors in hydrocarbon service where sulfur-sensitive catalysts are present downstream of the compressor.

PRODUCT	cSt @40°C	cSt @100°C	VI	Flash Point °F / °C	Pour Point °F / °C	ISO Grade
NGL-NS 220	220	23.2	130	370 / 188	-44 / -42	220

**PAPER MILL GREASE** SYNTHETIC PAPER/PULP PROCESSING GREASE (WITH SYNSLIDE)

Paper Mill Grease is the appropriate bearing lubricant for all paper machine bearings from the wet end through the dry end operating at speeds of 1500 RPM to 6500 RPM. Due to its superior film strength, it is highly recommended on wet end roll bearings, wire return rolls, couch rolls, suction press rolls, granite or synthetic covered press rolls and wet felt rolls. It is also recommended for dry end rolls such as dryer felt rolls, coater rolls, calendar rolls, winder rolls and super calendar rolls. (For shafts in excess of seven inches in diameter or speeds in excess of 3000 RPM, consult your Royal Purple representative or call Royal Purple's technical support staff at 281-354-8600.) Royal Purple Paper Mill Grease's versatility allows its use in auxiliary equipment such as pumps, refiners, fans and conveyors. Royal Purple Paper Mill Grease is a high performance, aluminum complex, synthetic grease designed to lubricate a wide range of typical paper/pulp processing applications using a single grease.

PRODUCT	Base Oil cSt @40°C	Base Oil cSt @100°C	VI	Drop Point °F / °C	NLGI Grade
Paper Mill Grease	244	24.0	122	536 / 280	1.5



**POLY-GUARD® FDA**

HIGH PERFORMANCE FDA/NSF CERTIFIED H1 OIL (WITH PUROLEC®)

Poly-Guard FDA is a superior anti-wear, long life, synthetic lubricant that is NSF Certified for H1 service and meets the FDA CFR Title 21 Section 178.3620(b) purity requirement. Poly-Guard FDA reduces wear and keeps equipment cleaner, allowing for substantially longer oil drain intervals. Poly-Guard FDA is an undyed product. Poly-Guard FDA is recommended for use in compressors, pumps, gear boxes, bearings, blowers or almost any other equipment in food processing or pharmaceutical plants requiring oil.

PRODUCT	cSt @40°C	cSt @100°C	VI	Flash Point °F / °C	Pour Point °F / °C	ISO Grade
Poly-Guard FDA 15	15	3.6	115	380 / 193	-85 / -65	15
Poly-Guard FDA 22	22	4.5	118	380 / 193	-71 / -57	22
Poly-Guard FDA 32	32	6.1	142	450 / 232	-38 / -39	32
Poly-Guard FDA 46	46	7.9	144	485 / 252	-38 / -39	46
Poly-Guard FDA 68	68	10.4	140	470 / 243	-38 / -39	68
Poly-Guard FDA 100	100	13.6	136	490 / 254	-56 / -49	100
Poly-Guard FDA 150	150	17.9	132	460 / 238	-44 / -42	150
Poly-Guard FDA 220	220	23.2	130	455 / 235	-49 / -45	220
Poly-Guard FDA 320	320	30.0	128	445 / 229	-44 / -42	320
Poly-Guard FDA 460	460	39.0	130	410 / 210	-38 / -39	460
Poly-Guard FDA 680	680	49.3	125	480 / 249	-15 / -26	680

**QUADREX®**

PREMIUM 4-CYCLE GAS ENGINE OIL (WITH SYNERLEC®)

Quadrex is a low ash, fuel saving, high performance, synthetic blend 4-cycle natural gas engine oil. Quadrex saves fuel and reduces maintenance costs. It extends drain intervals, ring and bearing life, prevents piston seizing and scuffing and keeps engines clean. Quadrex 40 14HB has a higher alkalinity for sour gas service.

PRODUCT	cSt @40°C	cSt @100°C	VI	Flash Point °F / °C	Pour Point °F / °C	Total Base No.	Sulfated Ash % Max	SAE Grade
Quadrex 40	126	13.6	104	485 / 252	-24 / -31	6	0.45	40
Quadrex 40 14HB	125	13.4	103	484 / 251	-24 / -31	14	1.6	40

**SYNDRALIC®**

PREMIERE HYDRAULIC OIL (WITH SYNERLEC®)

Syndralic is a clean, long life, energy efficient, minimum leak, hydraulic oil possessing exceptional film strength and wear protection properties. It is formulated to greatly increase both the life of the oil and the seals, filters and pumps of hydraulic systems. Syndralic can lower operating temperatures and restore normal operation to erratically operating hydraulic systems.

PRODUCT	cSt @40°C	cSt @100°C	VI	Flash Point °F / °C	Pour Point °F / °C	ISO 4406*	ISO Grade
Syndralic 32**	32	5.5	108	435 / 224	-49 / -45	14 / 13 / 11	32
Syndralic 46**	46	6.9	105	415 / 213	-44 / -42	14 / 13 / 11	46
Syndralic 68**	68	8.9	104	440 / 227	-27 / -33	14 / 13 / 11	68
Syndralic 150***	150	14.8	98	450 / 232	-27 / -33	—	150

\*Check with manufacturer regarding availability with 14/13/11 cleanliness; 14/13/11 ISO cleanliness rating is determined prior to addition of anti-foam additive.  
\*\*NSF Certified H2. \*\*\*Special Order Product.

**SYNERGY®**

HIGH PERFORMANCE EP GEAR OIL (WITH SYNSLIDE®)

Royal Purple's best-selling EP gear oil, Synergy is an ultra-tough, long life, gear oil with slippery, synthetic molecules, which greatly increase its lubricity and oiliness properties. Gears run smoother, quieter, cooler and longer without overhauls. Synergy is noncorrosive to both ferrous and nonferrous metals. Its ability to rapidly and completely separate from water prevents sludge and wear commonly found in wet gear boxes (such as cooling tower gear boxes). Synergy employs a dense, high molecular weight, synthetic cushioning additive to prevent fatigue failure in gears subjected to sudden shock loads. (Visit [royalpurpleindustrial.com](http://royalpurpleindustrial.com) and download the "Gear Lubrication Manual" and "Synergy Product Sheet" for more information.)

PRODUCT	cSt @40°C	cSt @100°C	VI	Flash Point °F / °C	Pour Point °F / °C	4-Ball Weld Load, kfg	AGMA/ ISO GRADE
Synergy 100	110	11.5	102	420 / 216	-33 / -36	400	100/3EP
Synergy 150	157	15.0	102	405 / 207	-30 / -34	400	150/4EP
Synergy 220	230	19.0	100	400 / 204	-33 / -36	315	220/5EP
Synergy 320	320	25.0	100	435 / 224	-30 / -34	400	320/6EP
Synergy 460	465	32.0	102	415 / 213	-24 / -31	400	460/7EP
Synergy 680	680	44.0	108	410 / 210	-24 / -31	400	680/8EP

**SYNERGY® WORM GEAR** PARA-SYNTHETIC WORM GEAR OIL

Synergy Worm Gear Oil contains slippery hydrocarbon molecules plus special anti-wear additives to provide the lubricity and oiliness properties necessary to excel in worm gear lubrication. This lubricant utilizes a dense, high molecular weight, synthetic cushioning additive that protects against fatigue failure from sudden shock loads. Royal Purple's worm gear oils are noncorrosive to both ferrous and nonferrous metals.

PRODUCT	cSt @40°C	cSt @100°C	VI	Flash Point °F / °C	AGMA / ISO Grade
Synergy Worm Gear 680	680	42.5	104	455 / 235	8 / 680
Synergy Worm Gear 1000	1000	58.5	113	455 / 235	8A / 1000

**SYNFILM®** SYNTHETIC AIR COMPRESSOR AND INDUSTRIAL OIL (WITH SYNERLEC®)

Synfilm is a clean, dry, long life, high film strength, energy efficient, synthetic lubricant that significantly increases bearing life and equipment reliability. Synfilm rapidly and completely separates from water and provides excellent protection against rust and corrosion. Synfilm users experience lower operating temperatures, reduced bearing vibration, extended oil drain intervals and longer equipment life. Royal Purple's best-selling industrial lubricant, Synfilm is recommended for use in air compressors, pumps, bearings, gears, air tools, etc.

PRODUCT	cSt @40°C	cSt @100°C	VI	Flash Point °F / °C	Pour Point °F / °C	Cinc. Mil. "A"	ISO Grade
Synfilm 32	32	5.8	126	430 / 221	-71 / -57	Pass	32
Synfilm 46	46	7.4	125	485 / 252	-58 / -50	Pass	46
Synfilm 68	68	9.6	122	455 / 235	-45 / -43	Pass	68
Synfilm 100	100	12.5	119	485 / 252	-45 / -43	Pass	100
Synfilm 150	150	16.5	117	500 / 260	-33 / -36	Pass	150

**SYNFILM® GT** MULTI-PURPOSE SYNTHETIC INDUSTRIAL OIL (WITH SYNERLEC®)

Synfilm GT is a clean, dry, long life, high film strength, energy efficient, synthetic lubricant that significantly increases bearing life and equipment reliability. Synfilm GT rapidly and completely separates from water, has very low temperature fluidity, provides excellent protection against rust and corrosion and is extremely oxidation stable, allowing for long oil life and extended oil drain intervals. Synfilm GT is recommended for use in gas and steam turbines, blowers and vacuum pumps, bearings, gears, air tools, etc. Synfilm GT should be considered instead of Synfilm when: oil reservoir temperatures exceed 175°F, improved low temperature fluidity is desired or when a viscosity grade is not available in Synfilm.

PRODUCT	cSt @40°C	cSt @100°C	VI	Flash Point °F / °C	Pour Point °F / °C	Cinc. Mil. "A"	ISO Grade	ISO 4406*
Synfilm GT 22	22	4.5	120	350 / 177	-71 / -57	Pass	22	—
Synfilm GT 32**	32	6.0	135	455 / 235	-38 / -39	Pass	32	14 / 13 / 11
Synfilm GT 46**	46	7.7	136	455 / 235	-38 / -39	Pass	46	14 / 13 / 11
Synfilm GT 68**	68	10.1	133	485 / 252	-38 / -39	Pass	68	14 / 13 / 11
Synfilm GT 100**	100	13.1	129	415 / 213	-44 / -42	Pass	100	—
Synfilm GT 150**	150	17.3	126	465 / 241	-44 / -42	Pass	150	—
Synfilm GT 220**	220	22.4	124	445 / 229	-44 / -42	Pass	220	—
Synfilm GT 320**	320	28.8	122	445 / 229	-40 / -40	Pass	320	—
Synfilm GT 460**	460	36.5	120	455 / 235	-44 / -42	Pass	460	—
Synfilm GT 680	680	47.9	121	455 / 235	-38 / -39	Pass	680	—

\*Check with manufacturer regarding availability with 14/13/11 cleanliness; 14/13/11 ISO cleanliness rating is determined prior to addition of anti-foam additive. \*\*NSF Certified H2. - Undyed versions available. See catalog product index.

**SYNFILM® GT WIND GEAR 320** SYNTHETIC WIND TURBINE GEAR BOX OIL (WITH SYNERLEC)

Synfilm GT Wind Gear 320 provides the same benefits as Synfilm GT, with respect to dryness, high film strength and oxidation resistance, but is also tailored to the needs of wind turbine gear boxes with enhanced filtration and anti-foam characteristics. This product provides increases in operational efficiency and enhanced protection against micro-pitting of gear faces. Synfilm GT Wind Gear 320 is an un-dyed product.

PRODUCT	cSt @40°C	cSt @100°C	VI	Flash Point °F / °C	Pour Point °F / °C	Cinc. Mil. "A"	ISO Grade
Synfilm® GT Wind Gear 320	320	28.8	122	445 / 229	-40 / -40	Pass	320

**SYNFILM® NGL** HYDROCARBON GAS COMPRESSOR OIL (WITH SYNERLEC®)

Synfilm NGL is a long life, high film strength, synthetic lubricant specifically designed to increase the service life of rotary screw, centrifugal, rotary vane and reciprocating gas compressors in hydrocarbon service. Synfilm NGL is the ideal lubricant for gas compressor service because it is formulated with dense, closely packed molecules to greatly resist dilution from compressed hydrocarbon gases. Its high film strength protects bearings, cylinders, rings and rider bands from wear. Synfilm NGL has excellent thermal and oxidation stability to minimize deposits and to extend oil drain intervals. It also has a low coefficient of friction to maximize energy savings and to protect bearings and other components from rust and corrosion.

PRODUCT	cSt @40°C	cSt @100°C	VI	Flash Point °F / °C	Pour Point °F / °C	ISO Grade
Synfilm NGL 46	46	7.7	135	455 / 235	-76 / -60	46
Synfilm NGL 100	100	13.8	130	470 / 243	-44 / -42	100
Synfilm NGL 150	150	17.4	127	500 / 260	-49 / -45	150
Synfilm NGL 220	220	22.5	125	500 / 260	-49 / -45	220



**SYNFILM® RECIP** RECIPROCATING AIR COMPRESSOR OIL (WITH SYNERLEC®)

Synfilm Recip. is a long life, high film strength, energy efficient, synthetic lubricant that excels in the lubrication of reciprocating air compressors. Synfilm Recip. has excellent solvency properties and outstanding oxidation stability that virtually eliminates carbon build-up on discharge valves, a common problem for reciprocating compressors.

PRODUCT	cSt @40°C	cSt @100°C	VI	Flash Point °F / °C	Pour Point °F / °C	ISO Grade
Synfilm Recip. 100	100	9.5	60	485 / 252	-38 / -39	100
Synfilm Recip. 150	150	12.5	65	495 / 257	-38 / -39	150

**THERMASIL™ T-100** MAXIMUM LOAD SILICA GEL SYNTHETIC GREASE (WITH SYNSLIDE®)

Thermasil T-100 is a viscous, water resistant, tacky grease designed to protect extremely heavily loaded, low speed bearings or sliding surfaces (such as open gears, skid-rails, etc.) that operate in wet or hot environments where other EP greases perform poorly or even fail. Thermasil T-100 is extremely resistant to water washout and provides excellent corrosion protection. It is especially suited for lubricating very low speed, heavily loaded bearings, bushings, pinions, gears, sliding surfaces, etc. Thermasil T-100 is an undyed product.

PRODUCT	Base Oil cSt @40°C	Drop Point °F / °C	NLGI Grade
Thermasil T-100	4866	n/a	0

**THERMAX™ 680 GREASE** SPECIAL PURPOSE EP GREASE (WITH SYNSLIDE®)

Thermax 680 Grease is a special purpose, ultra-tough, aluminum complex, synthetic grease. It is designed to lubricate equipment requiring grease with a high viscosity base oil. Thermax 680 Grease has very good oxidation stability, greatly resists water washout and provides rust and corrosion protection to both ferrous and nonferrous metals. Thermax 680 Grease excels in bearings and sliding surfaces that operate at low speeds, under heavy or shock loads, at high temperatures or in wet environments. Typical applications can be found in steel mills, paper mills or in marine service. Thermax 680 Grease is recommended for low speed or high temperature bearings requiring the use of a grease formulated with a heavy base oil.

PRODUCT	Base Oil, cSt @40°C	Base Oil, cSt @100°C	Drop Point °F / °C	NLGI Grade	Worked Cone Penetration	4-Ball Weld Load, kfg
Thermax 680 grease	628	46.3	522 / 272	2	285	315

**THERMYL-GLYDE®** SEVERE SERVICE GEAR AND BEARING OIL (WITH SYNSLIDE®)

Thermyl-Glyde is an ultra-tough, multi-synthetic lubricant for severe service gears, bearings, couplings and ways. Thermyl-Glyde is noncorrosive to both ferrous and nonferrous metals and rapidly and completely separates from water, preventing the sludge and wear commonly found in wet gear boxes. Thermyl-Glyde employs a dense, high molecular weight, synthetic cushioning additive to prevent fatigue failure in gears subjected to sudden shock loads. (For more information, ask for our "Gear Lubrication Manual" and "Thermyl-Glyde Product Sheet". Thermyl-Glyde gear oil has all of the advantages of Synergy but is recommended where heavy loads, shock loads, low operating speeds and/or high operating temperatures are encountered.

PRODUCT	cSt @40°C	cSt @100°C	VI	Flash Point °F / °C	Pour Point °F / °C	AGMA/ ISO Grade
Thermyl-Glyde 220	220	23.1	129	375 / 191	-44 / -42	5EP/220
Thermyl-Glyde 320	320	29.5	126	375 / 191	-38 / -39	6EP/320
Thermyl-Glyde 460	460	37.7	125	375 / 191	-38 / -39	7EP/460
Thermyl-Glyde 680	680	49.6	126	330 / 166	-33 / -36	8EP/680
Thermyl-Glyde 1000	1000	64.8	127	355 / 179	-27 / -33	8AEP/1000
Thermyl-Glyde 1500	1500	82.7	124	330 / 166	-22 / -30	-/1500

\*Special order product.

**THERMYL-GLYDE® WORM GEAR OIL** SYNTHETIC GEAR OIL (WITH DYNAGLYDE®)

Thermyl-Glyde Worm Gear Oil is a high film strength, slippery, synthetic lubricant with special anti-wear additives to provide the lubricity and oiliness properties necessary to excel in worm gear lubrication (including cylindrical and double enveloping worm gears). Thermyl-Glyde Worm Gear Oil utilizes a dense, high molecular weight, synthetic cushioning additive that protects against fatigue failure from sudden shock loads. Thermyl-Glyde Worm Gear Oil is noncorrosive to both ferrous and nonferrous metals, has excellent oxidation stability and water separating properties and will not turn rancid (a common problem with other worm gear oils). Textron/Cone drive approved. Thermyl-Glyde Worm Gear Oil is recommended for use in very heavily loaded, slow speed and/or high temperature worm gear service.

PRODUCT	cSt @40°C	cSt @100°C	VI	Flash Point °F / °C	AGMA/ ISO Grade
Thermyl-Glyde Worm Gear 460	460	36.5	120	400 / 204	7/460
Thermyl-Glyde Worm Gear 680	680	47.6	120	405 / 207	8/680



**THERMYL-TUFF™** MAXIMUM LOAD SYNTHETIC LUBRICANT (WITH SYNSLIDE®)

Thermyl-Tuff is a viscous, tacky, semi-fluid lubricant that protects extremely heavily loaded sliding surfaces such as open gears, skid rails, etc., where other EP products perform poorly or even fail. Thermyl-Tuff cannot be washed off by water and its superior, synthetic corrosion inhibitors provide outstanding protection in wet and/or corrosive environments. Thermyl-Tuff is an undyed product. Thermyl-Tuff is recommended for heavily loaded open gears, skid rails, bushings, couplings, bearings, cables, etc., or low speed bearings operating at high temperatures.

PRODUCT	cSt @40°C	cSt @100°C	VI	Pour Point °F / °C
Thermyl-Tuff 200	8800	256	130	+10 / -12
Thermyl-Tuff 300	16000	457	154	+16 / -9

**TUFF COAT M** PREMIUM MARINE CORROSION AND WEAR PROTECTION

Tuff Coat M contains specially formulated synthetic lubricants, penetrants and synthetic additives, which significantly extend the service life of wire ropes armored cables and ROV umbilicals over a wide range of temperatures and working conditions common to the marine industry. Tuff Coat M has state-of-the-art corrosion inhibitors, exceptional penetrating and wetting ability and a strong adhesive film to keep the lubricant in place

PRODUCT	cSt @40°C	cSt @100°C	VI	Flash Point °F / °C	Pour Point °F / °C
Tuff Coat M	1960	108	136	464 / 240	-22 / -30

**ULTRA-PERFORMANCE® GREASE** SYNTHETIC GREASE (WITH SYNSLIDE®)

Ultra-Performance Grease is a high performance, aluminum complex grease. It has outstanding EP capabilities and excellent water resistance to both emulsion and washout. Ultra-Performance Grease can be pumped at low temperatures, is stable at high temperatures and has excellent oxidation resistance to extend service life and to provide a margin of safety between lubrication intervals. Ultra-Performance Grease satisfies the widest range of grease requirements and is recommended for bearings and general purpose use.

PRODUCT	Base Oil cSt @40°C	Base Oil cSt @100°C	Drop Point °F / °C	NLGI Grade	Worked Cone Penetration	4-Ball Weld Load, kgf
Ultra-Performance Grease 1	180	16.2	525 / 274	1	315	400
Ultra-Performance Grease 2	180	16.2	525 / 274	2	285	400

**UNI-TEMP™** SYNTHETIC REFRIGERATION OIL (WITH SYNERLEC®)

Uni-Temp is a long-life, high film strength refrigeration lubricant that provides superior performance in both rotary screw and reciprocating refrigeration compressors. Uni-Temp is wax free and remains fluid at temperatures as low as -90°F/-67°C. By not congealing on the evaporator coils, cooling efficiency is maximized and the need for system shut down to clean the coils is eliminated. Uni-Temp is proven to virtually eliminate high oil consumption problems while producing average documented energy savings that exceed 5%. Uni-Temp is recommended for use with ammonia, propane and all fluorocarbon (CFC, HCFC) refrigerants, including R-12, R-22, R-114, etc. Uni-Temp has not been extensively tested in service with HFC refrigerants. Uni-Temp is NSF certified for H2 service and is an undyed product.

PRODUCT	cSt @40°C	cSt @100°C	Viscosity Index	Flash Point °F / °C	Pour Point °F / °C	Timken Ok Load, lb/kfg	ISO Grade
Uni-Temp 150	32	5.7	118	445 / 229	-70 / -56	60 / 27	32
Uni-Temp 300	63	9.0	118	445 / 229	-51 / -46	60 / 27	68

**VP™ PRESERVATIVE OIL 10** VAPOR PHASE CORROSION INHIBITOR

VP Preservative Oil 10 is an oil that prevents rust and corrosion of all metal surfaces to which it is applied. It also fills closed spaces with vapors that prevent rust and corrosion of surfaces not contacted by the oil. VP Preservative Oil 10 is an undyed product. VP Preservative Oil 10 is recommended for use to prevent rust and corrosion in engines, gearboxes and other closed systems that will be stored for periods up to one year or more.

PRODUCT	Base Oil cSt @40°C	Fla Point °F / °C
VP Preservative Oil 10	20	400 / 204

**WIRE ROPE LUBRICANT** (WITH SYNSLIDE®)

Royal Purple's Wire Rope Lubricant contains specially formulated synthetic lubricants, penetrants and synthetic additives that significantly extend the service life of wire ropes over a wide range of temperatures and working conditions common to the mining, marine and construction industries. Wire Rope Lubricant has state-of-the-art corrosion inhibitors, exceptional penetrating and wetting ability and a strong adhesive film to keep the lubricant in place.

PRODUCT	cSt @40°C	cSt @100°C	VI	Flash Point °F / °C	Pour Point °F / °C
Wire Rope Lubricant	483	33.5	112	405 / 207	-33 / -36

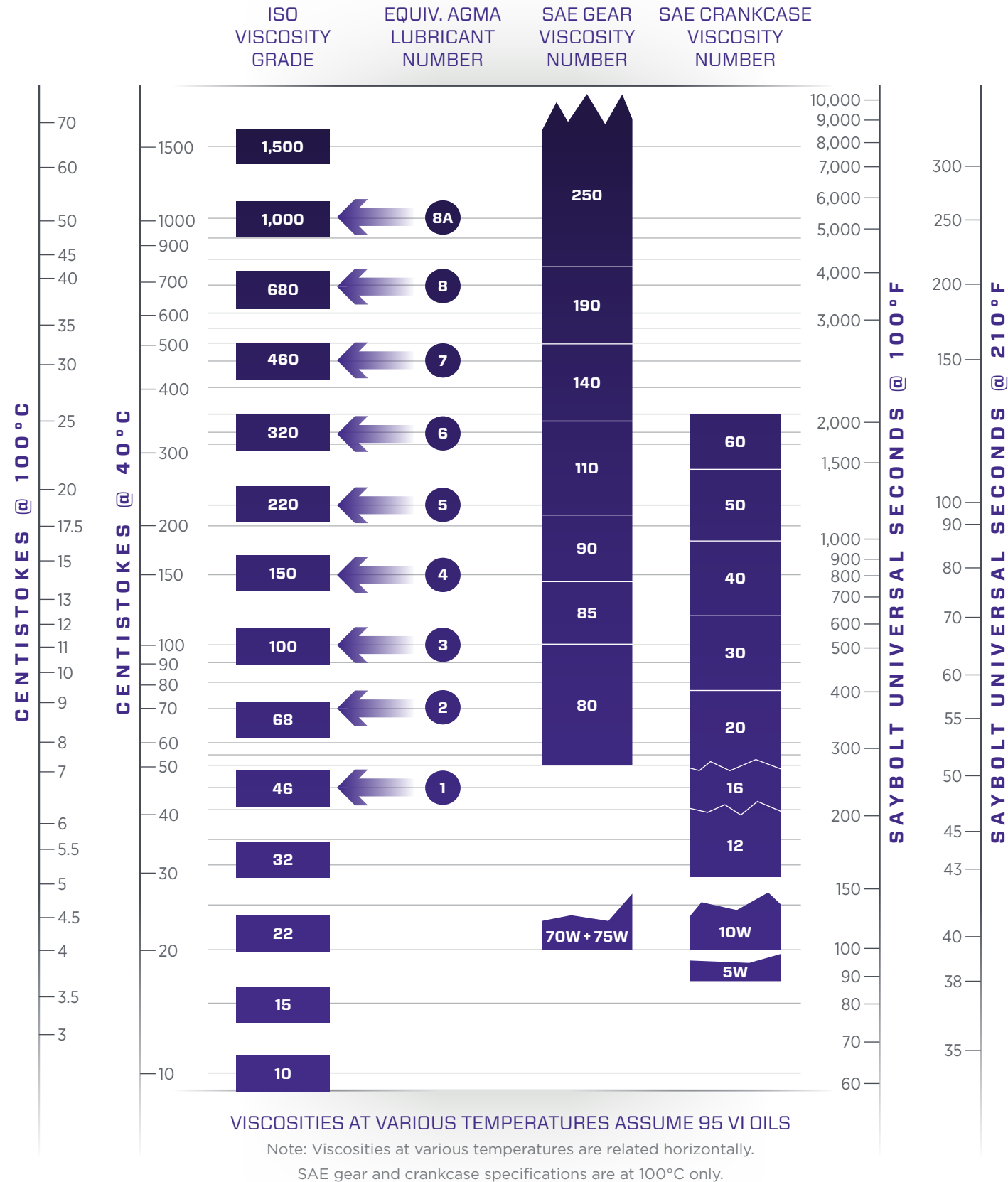




*TECHNICAL APPENDIX*

BEYOND SYNTHETIC

# COMPARATIVE VISCOSITY CLASSIFICATIONS



international Standards Organization (ISO) Viscosity Grades			
ISO Grade	Viscosity Range cSt @ 40 °C	Approximate Range* SUS @ 100 °F	Approximate Range* SUS @ 210 °F
2	1.98 - 2.42	32.8 - 34.4	—
3	2.88 - 3.52	36.0 - 38.2	—
5	4.1 - 5.06	40.4 - 43.5	—
7	6.12 - 7.48	47.2 - 52.0	—
10	9.0 - 11.0	57.6 - 65.3	34.6 - 35.7
15	13.5 - 16.5	75.8 - 89.1	37.0 - 38.3
22	19.8 - 24.2	105 - 126	39.7 - 41.4
32	28.8 - 35.2	149 - 182	43.0 - 45.0
46	41.4 - 50.6	214 - 262	47.1 - 49.9
68	61.2 - 74.8	317 - 389	52.9 - 56.9
100	90 - 110	468 - 575	61.2 - 66.9
150	135 - 165	709 - 871	73.8 - 81.9
220	198 - 242	1047 - 1283	90.4 - 101
320	288 - 352	1533 - 1881	112 - 126
460	414 - 506	2214 - 2719	139 - 358
680	612 - 748	3298 - 4048	178 - 202
1000	900 - 1100	4864 - 5975	226 - 256
1500	1350 - 1650	7365 - 9079	291 - 331

\* Assumes viscosity index (VI) of 95.

## COMMON INDUSTRIAL LUBRICANTS

### ROYAL PURPLE RECOMMENDATIONS

The industrial and racing markets associate outstanding quality and superior performance with Royal Purple. This reputation has been earned through Royal Purple's relentless pursuit of excellence in lubrication.

Royal Purple formulates the most advanced lubricants available on the market today. If you currently use Royal Purple's products, you already know this. If you do not, they offer the opportunity to greatly improve the reliability and efficiency of your equipment and to lower your operating costs.

R&O Oils	Anti-Wear (AW) Hydraulic Oils	Extreme Pressure Gear Oils
<p>These are generally mineral oils containing small amounts of rust and oxidation inhibitors and no anti-wear additives. R&amp;O oils are sometimes referred to as circulating oils, turbine oils, gear and bearing oils or simply by their AGMA gear oil classification (example AGMA 5 R&amp;O gear oil).</p> <p><b>Some of the most common brand names of R&amp;O oils are:</b></p> <ul style="list-style-type: none"> <li>• Mobil DTE® (light, medium, etc.)</li> <li>• Exxon Terestic® (32, 46, etc.)</li> <li>• Shell Turbo® &amp; Turbo® T</li> <li>• Chevron GST</li> </ul> <p>When an OEM recommends the use of an Industrial R&amp;O Oil, Royal Purple generally recommends:</p> <p><b>Synfilm or Synfilm GT.</b></p>	<p>These are generally mineral oils that contain anti-wear additives along with rust and oxidation inhibitors.</p> <p><b>Some of the most common brand names for AW hydraulic oils are:</b></p> <ul style="list-style-type: none"> <li>• Mobil DTE® 20 series</li> <li>• Exxon Nuto® H</li> <li>• Shell Tellus®</li> <li>• Chevron Clarity AW®</li> </ul> <p>When an OEM recommends the use of an AW hydraulic oil, Royal Purple generally recommends:</p> <p><b>Syndraulic</b></p>	<p>These are generally mineral oils that contain sulfur phosphorous additives that generally meet AGMA EP performance requirements.</p> <p><b>Some of the most common brand names for EP gear oils are:</b></p> <ul style="list-style-type: none"> <li>• Mobil Mobilgear®</li> <li>• Exxon Spartan® EP</li> <li>• Shell Omala®</li> <li>• Chevron Gear Compound EP</li> </ul> <p>When an OEM recommends the use of an EP gear oil, Royal Purple recommends:</p> <p><b>Synergy or Thermyl-Glyde</b></p>

## BEARING LIFE FORMULA

### ISO ADJUSTED BEARING LIFE FORMULA FOR ANTI-FRICTION BEARINGS

The ISO adjusted bearing life formula is used by bearing manufacturers and equipment design engineers to predict the service life of anti-friction bearings.

$$L_{na} = a_{23} (L_{10})$$

$L_{na}$  = Actual bearing life (millions of revolutions)

$(L_{10})$  = Bearing design life (includes all design and installation parameters such as fit, alignment, balance, etc.)

$a_{23}$  = Oil film thickness + composite surface roughness (composite surface roughness = combined roughness of the bearing and the opposing race;  $a_{23}$  is also called "relative oil film thickness")

#### THIS FORMULA ILLUSTRATES:

1. The quality of lubrication is as important as the mechanical factors in determining the bearing life.
2. Oil film thickness must at least equal the combined surface roughness of the bearing and race in order for the bearing to reach its design life in service.
3. Bearing life is increased in direct proportion to:
  - a) the percentage increase in the thickness of the oil film.
  - b) the percentage reduction in the composite surface roughness.

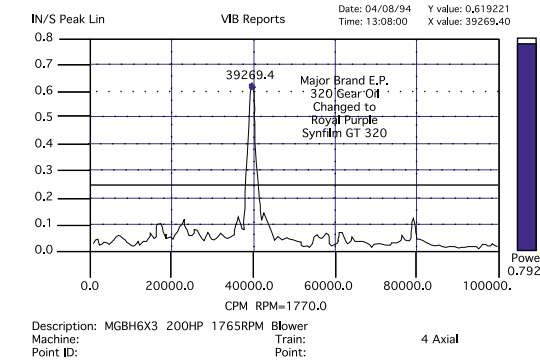
BEARING LIFE IS GREATLY INCREASED BY A COMBINATION OF BOTH A & B.

**Note:** Less than 10 percent of bearings in service ever reach their design life; however, improving relative oil film thickness can increase bearing life up to 4 times its design life.

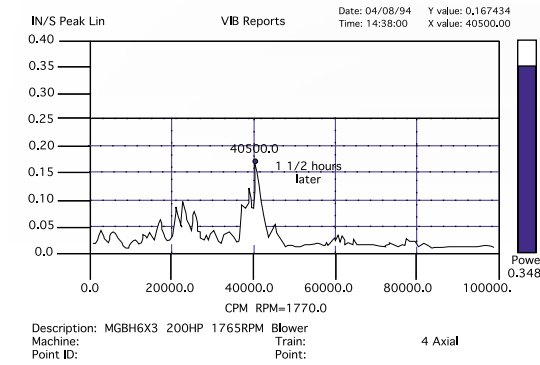
**Royal Purple's oils with Synerlec additive technology greatly increases bearing life by both increasing oil film thickness and smoothing bearing surfaces.**

"Our vibration analyst predicted bearing failure was imminent, so we decided to try Royal Purple. We replaced the SAE 30 Shell oil with Royal Purple Synfilm 100 and the vibration and noise abated immediately and ran for eleven months."

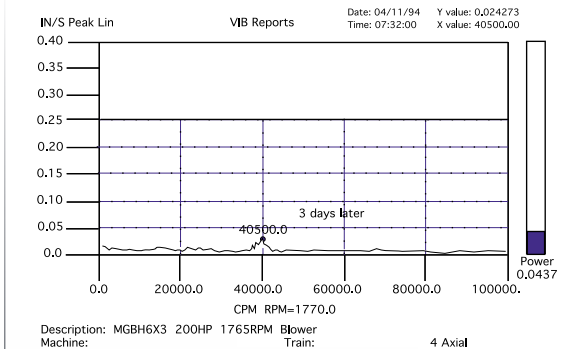
## MIRCO-MENDING REDUCES VIBRATIONS



200 HP Roots Blower at a chemical plant is experiencing high vibrations while being lubricated with a competitor's ISO 320 EP gear oil.



Same blower 1 1/2 hours after the oil is changed to Royal Purple Synfilm GT 320.



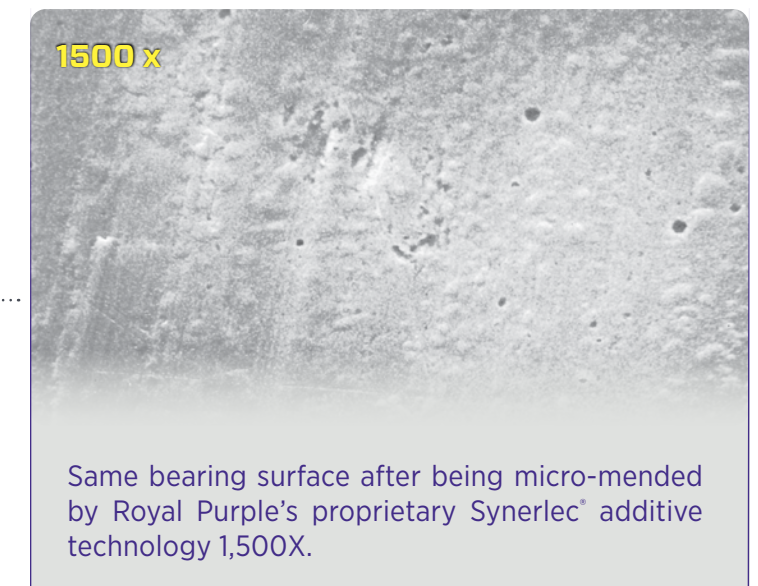
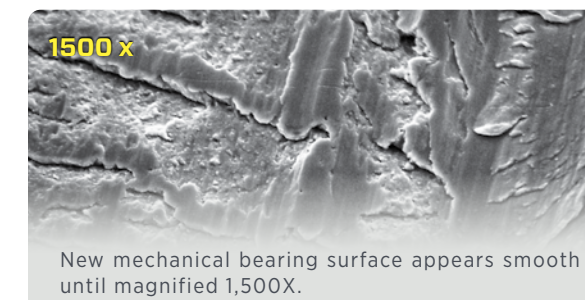
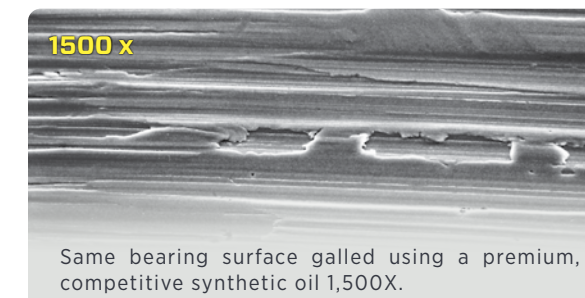
Same blower three days after the oil is changed to Royal Purple Synfilm GT 320.

#### Impact of Vibration Reduction on Bearing Life Assumes dynamic load is the major force component

% Reduction in Vibration	Percent Increase in Bearing Life	
	Ball Bearing Types	Other Rolling Element Bearing
5	17	19
10	37	42
15	63	72
20	95	110
25	137	161
30	192	228
40	363	449
50	700	908

Table provided courtesy of L. Douglas Berry, Reliability Magazine

## MICROSCOPIC PHOTOS OF MICRO-MENDING



## ISO 4406:99 CLEANLINESS LEVEL STANDARDS

### OIL CLEANLINESS

Clean oil greatly extends the life of bearings and equipment. Most oils are not clean. They don't look dirty, but they are full of small particles in the 2 to 30 micron range that the eye cannot see, yet they are very damaging to equipment. These particles consist mainly of fibers, silica (dirt) and metals.

The amounts and sizes of particles can be measured with a laser particle counter and then quantified using the ISO 4406:99 Cleanliness Rating, which reports on the particle content of 1 milliliter of oil (approximately equal to one eye dropper).

ISO 4406:99 Cleanliness level standards		
Range Number	Number of Particles per ml	
	More Than	Up to and Including
24	80,000	160,000
23	40,000	80,000
22	20,000	40,000
21	10,000	20,000
20	5,000	10,000
19	2,500	5,000
18	1,300	2,500
17	640	1,300
16	320	640
15	160	320
14	80	160
13	40	80
12	20	40
11	10	20
10	5	10
9	2.5	5
8	1.3	2.5
7	.64	1.3
6	.32	.64

**Note:** The classification rating follows a geometric progression where each level decreases in cleanliness and is twice as dirty as the previous level.

### OIL CLEANLINESS LEVELS MAY BE REPORTED USING EITHER A TWO OR THREE DIGIT RATING.

The cleanliness level of an oil with a particle count of:

2000 ≥ 4 microns / 500 ≥ 6 microns / 60 ≥ 14 microns would be reported as 18/16/13

example

An Oil with ISO Code

PARTICLES  
≥ 4 Microns

**18 / 16 / 13**

PARTICLES  
≥ 14 Microns

PARTICLES  
≥ 6 Microns

Royal Purple's best selling bearing and hydraulic oils are extremely clean, having a typical ISO cleanliness rating of 14/13/11.

**QUALITY ISN'T EXPENSIVE. IT'S PRICELESS!™**

## CLEARANCES OF ROTATING EQUIPMENT

**BECAUSE MACHINE CLEARANCES ARE VERY SMALL, OIL SHOULD BE EXTREMELY CLEAN.**

Typical Dynamic Clearances of rotating equipment	
Component	Dynamic Clearances
Gears	0.1 - 1.0 microns
Journal Bearings	0.5 - 100 microns
Pump, Gear Tooth to Side Plate/to Case	0.5 - 5.0 microns
Pump, Piston Piston to Bore Valve Plate to Cylinder	5.0 - 40 microns 0.5 - 5.0 microns
Pump, Vane Vane Sides Vane Tips	5.0 - 13 microns 0.5 - 1.0 microns
Rolling Element Bearings	0.1 - 1.0 microns
Valves Directional Spool to Sleeve Proportional Spool to Sleeve Servo Spool to Sleeve	2.0 - 8.0 microns 1.0 - 6.0 microns 1.0 - 4.0 microns

Concern for the size and amount of solid particulates that are ≥ 2 microns becomes evident when examining typical mechanical clearances for equipment. Particulates that are larger than the mechanical clearances greatly accelerate wear by abrasion.



## MEASURING THE BENEFIT OF CLEAN OIL

### EFFECT OF FLUID CLEANLINESS ON ROLLING CONTACT BEARING LIFE

Current Machine Cleanliness (ISO 4406)	Life Extension Factor (LEF)									
	B/A	2X	3X	4X	5X	6X	7X	8X	9X	10X
26/23	22/19	20/17	18/15	17/14	16/13	15/12	15/12	14/11	14/11	
25/22	21/18	19/16	17/14	16/13	15/12	14/11	14/11	13/10	13/10	
24/21	20/17	18/15	17/14	16/13	15/12	14/11	13/10	13/10	12/9	
23/20	19/16	17/14	15/12	14/11	13/10	13/10	12/9	11/8	11/8	
22/19	18/15	16/13	14/11	13/10	12/9	11/8	11/8	—	—	
21/18	17/14	15/12	13/10	12/9	11/8	11/8	—	—	—	
20/17	16/13	14/11	13/10	11/8	—	—	—	—	—	
19/16	15/12	<b>13/10</b>	11/8	—	—	—	—	—	—	
18/15	14/11	12/9	—	—	—	—	—	—	—	
17/14	13/10	11/8	—	—	—	—	—	—	—	
16/13	12/9	—	—	—	—	—	—	—	—	
15/12	11/8	—	—	—	—	—	—	—	—	
14/11	11/8 <sup>1</sup>	—	—	—	—	—	—	—	—	
13/10	11/8 <sup>1</sup>	—	—	—	—	—	—	—	—	
12/9	11/8 <sup>2</sup>	—	—	—	—	—	—	—	—	

1 Life Extension Factor 1.5

2 Life Extension Factor 1.3

In the above example, improving the ISO 4406:99 cleanliness level of a bearing oil from 20/17 to 13/10 will increase antifriction bearing life by 4 (400 percent increase).

### EFFECT OF FLUID CLEANLINESS ON HYDRAULIC SYSTEM LIFE

Current Machine Cleanliness (ISO 4406)	Life Extension Factor (LEF)									
	B/A	2X	3X	4X	5X	6X	7X	8X	9X	10X
26/23	23/21	22/19	21/18	20/17	20/17	19/16	19/16	18/15	18/15	
25/22	23/19	21/18	20/7	19/16	19/15	18/15	18/14	17/14	17/14	
24/21	21/18	20/17	19/16	19/15	18/14	17/14	17/13	16/13	16/13	
23/20	20/17	19/16	18/15	17/14	17/13	16/13	16/12	15/12	15/11	
22/19	19/16	18/15	17/14	16/13	16/12	15/12	14/11	14/10	14/10	
21/18	18/15	17/14	16/13	15/12	15/11	14/11	14/10	14/10	13/10	
20/17	17/14	16/13	15/12	14/11	<b>13/11</b>	13/10	13/9	12/9	12/8	
19/16	16/13	15/12	14/11	13/10	13/9	12/9	12/8	11/8	11/8	
18/15	15/12	14/11	13/10	12/9	12/8	11/8	—	—	—	
17/14	14/11	13/10	12/9	12/8	11/8	—	—	—	—	
16/13	13/10	12/9	11/8	—	—	—	—	—	—	
15/12	12/9	11/8	—	—	—	—	—	—	—	
14/11	11/8	—	—	—	—	—	—	—	—	
13/10	11/8 <sup>1</sup>	—	—	—	—	—	—	—	—	
12/9	11/8 <sup>2</sup>	—	—	—	—	—	—	—	—	

1 Life Extension Factor 1.5

2 Life Extension Factor 1.45

In the above example, improving the ISO 4406:99 cleanliness level of a hydraulic oil from 20/17 to 13/11 will increase hydraulic system life by 6 (600 percent increase).

Table provided courtesy of Diagnostics, Inc.

## MEASURING THE BENEFIT OF DRY OIL

### EFFECT OF MOISTURE CONTENT ON MACHINE LIFE

Current Moisture Level (PPM)	Life Extension Factor (LEF)									
	B/A	2X	3X	4X	5X	6X	7X	8X	9X	10X
50,000	12,500	6,500	4,500	3,125	2,500	2,000	1,500	1,000	782	
25,000	6,250	3,250	2,250	1,563	1,250	1,000	750	500	391	
10,000	2,500	1,300	900	625	500	400	300	200	156	
5,000	1,250	650	450	313	250	200	150	100	78	
2,500	625	325	225	156	125	100	75	50	39	
1,000	250	130	90	63	50	40	30	20	16	
500	125	65	<b>45</b>	31	25	20	15	10	8	
250	63	33	23	16	13	10	8	5	4	
100	25	13	9	6	5	4	3	2	2	

In the above example, reducing the water content of an oil from 500 ppm to 45 ppm would increase the machine life by 4 (400 percent).

Royal Purple industrial lubricants rapidly separate from water, allowing water to easily be drained from the bottom of oil reservoirs. In addition, Royal Purple's proprietary additive technologies ionically bond with all metal surfaces displacing harmful moisture.

### 1 DROP OF WATER PER LITER OF OIL IS APPROXIMATELY 200 PPM (0.02%)

1.0% Water = 10,000 ppm • 0.1% Water = 1,000 ppm • 0.01% Water = 100 ppm

## VALUE OF ENERGY SAVINGS

Royal Purple's lubricants typically produce energy savings that quickly exceed the total cost of the oil. Royal Purple has prepared this chart as a simple means of documenting these savings.

Electric Motor Size	Dollars of Energy Savings per 1000 operating hours										1000 hour energy cost						
	500 H.P.	250 H.P.	100 H.P.	50 H.P.	20 H.P.	5 H.P.	1 H.P.	Amount of Energy Saved	1%	2%		3%	4%	5%	6%	7%	8%
500 H.P.	414.45	828.90	1243.35	1657.80	2072.25	2486.70	2901.15	3315.60	3730.05	4144.50	<b>\$41,445.00</b>						
250 H.P.	207.23	414.45	621.68	828.90	1036.13	1243.35	1450.58	1657.80	1865.03	2072.25	<b>\$20,722.50</b>						
100 H.P.	82.89	165.78	248.67	331.56	414.45	497.34	580.23	663.12	746.01	828.90	<b>\$8,289</b>						
50 H.P.	41.45	82.90	123.35	165.80	207.25	248.70	290.15	331.60	373.05	414.50	<b>\$4,144</b>						
20 H.P.	16.58	33.16	49.74	66.32	82.90	99.48	116.06	132.64	149.22	165.80	<b>\$1,658</b>						
5 H.P.	4.14	8.28	12.42	16.56	20.70	24.84	28.98	33.12	37.26	41.40	<b>\$414</b>						
1 H.P.	0.83	1.66	2.49	3.32	4.15	4.98	5.81	6.64	7.47	8.30	<b>\$83</b>						

This chart provides a simplified method for estimating the total power cost for operating electric motors and documenting the actual dollars saved (through energy savings) as a result of changing to Royal Purple's energy efficient lubricants.

### THIS FORMULA ILLUSTRATES:

- A motor efficiency rating of 0.9 was selected because it is a typical value.
  - An electrical cost of \$0.10 per kilowatt hour was selected for simplification.
- (If actual cost is \$0.06/kw/hr., multiply savings by 0.6; if cost is \$0.12/kw/hr., multiply savings by 1.2, etc.)

Table provided courtesy of Diagnostics, Inc.

## INTRODUCING NEW GREASE

### HOW TO INTRODUCE A NEW LUBRICANT WHEN GREASE COMPATIBILITY IS UNKNOWN

Often, for one reason or another, it becomes necessary to change the brand of grease used to lubricate a particular machine. If the grease in use may become mixed with a new brand, the question of grease compatibility must be addressed to ensure trouble-free changeover.

Grease compatibility is a complex subject because of the many variables and changing conditions involved. At one end of the scale, mixing a fresh lubricant with a severely oxidized portion of the same lubricant may produce immediate or progressive changes in the mixture. At the other end of the scale, greases with different thickeners may be mixed resulting in hardening or very soft or low melting mixtures, which may not provide adequate lubrication and may lead to early failures. Add to this the diverse operating conditions of time, temperature, and contaminants — and the uncertainties of predicting or measuring compatibility of greases are apparent. There is no practical rule one can apply to all mixtures of different greases to determine compatibility properties.

Grease compatibility tests are run with a 30/70, 50/50 and 70/30 concentration of the two greases tested. Additionally, the temperature is elevated well beyond normal operating range to insure a margin of safety. If testing reveals either marginal compatibility or complete incompatibility between two greases, changing lubricants will require some specific procedures.

### RECOMMENDED PROCEDURES TO INTRODUCE NEW GREASE

In order to maintain the integrity of the grease and mitigate any potential damage to the equipment, the following procedures are recommended based on the type of lubricator in service:

#### AUTOMATIC LUBRICATORS

There is no safe alternative to purging the system and all lines, which will require some downtime for equipment serviced by the lubricator.

For a safe purge to be reasonably effective the following are the most important guidelines:

1. Exit path for old grease – the purge line must be clear, the vent cap must be removed and if the exit path is the grease seal, it must be pliable. If there is no planned or engineered exit path for old grease, the bearings will have to be uncapped and cleaned manually.
2. Size of the bearings - as bearing size increases, the amount of grease necessary to purge and adequately re-lubricate also increases. Bearings on shafts larger than 10 inches may require almost double the normal amount of grease.
3. Even after purging and re-greasing, the vent cap or plug should remain open for several hours to ensure the bearing can adjust to the proper amount of grease. Some re-lubrication may be necessary after resealing the bearing cavity.

#### MANUALLY LUBRICATED BEARINGS

On manually lubricated bearings, a safe purge of the old grease can normally be accomplished without a significant change in normal re-lubrication practice.

For most bearings that are manually lubricated via an allemite (zerk) fitting and are vented with a plug or vent tube, the following procedure should be adequate:

1. Remove the vent cap or plug first. Using the straw extension tube, spray a good supply of Maxfilm into the exit opening. This will soften and remove any caked or plugged grease.
2. Remove the grease fitting and follow same procedure with the inlet tube. Care should be taken if equipment is running as some blow-back may occur on faster bearings.
3. Allow 5 to 10 minutes for Maxfilm to soften any hardened grease. Re-lubricate with the new grease and pump a sufficient amount of grease until new clean grease is exiting the vent tube or grease seal. Run the equipment for 20 to 30 minutes, re-cap or plug if necessary and add some grease to compensate for any that was purged while running.
4. On larger bearings this may need to be repeated in 24 – 48 hours.
5. On capped or sealed bearing cavities, the bearing will have to be opened or exposed so that a thorough flush with Maxfilm can be accomplished. Then simply re-lubricate with the proper amount.

Royal Purple does not recommend the use of solvents or other agents for this type of cleaning Maxfilm is suggested because of its natural solvency combined with its lubricating ability. The residue will not harm the bearing but will in fact help to lubricate during the transition.

As with any oil or grease change if the equipment condition changes, such as an increase in noise, vibration or temperature, re-lubricate immediately.

“When greases made from different thickeners are mixed, the mixture may be poorer in service performance or physical properties than either of the component products. This lessening in performance capability is called incompatibility. It may show up in any of several areas, such as, (1) lower heat resistance (2) change in consistency, usually softening, or (3) decrease in shear stability. Mixtures which show none of these changes are considered compatible.”

—NLGI Lubricating Grease Guide,  
Fourth Edition

## GREASE COMPATIBILITY CHARTS

### General Grease Compatibility Chart

	Aluminum Complex	Barium	Calcium	Calcium 12-Hydroxy	Calcium Complex	Calcium Sulfate	Clay	Lithium	Lithium 12-Hydroxy	Lithium Complex	Polyurea	Silicone
Aluminum Complex	X	I	I	C	I	I	I	I	I	C	I	I
Barium	I	X	I	C	I	B	I	I	I	I	I	I
Calcium	I	I	X	C	I	-	I	I	I	C	I	I
Calcium 12-Hydroxy	C	C	C	X	B	-	C	C	C	C	I	I
Calcium Complex	I	I	I	B	X	C	I	I	I	C	C	I
Calcium Sulfate	I	B	-	-	C	X	I	C	C	C	I	I
Clay	I	I	C	C	I	I	X	I	I	I	I	I
Lithium	I	I	C	C	I	C	I	X	C	C	I	I
Lithium 12-Hydroxy	I	I	B	C	I	C	I	C	X	C	I	I
Lithium Complex	C	I	C	C	C	C	I	C	C	X	I	I
Polyurea	I	I	I	I	C	I	I	I	I	I	X	I
Silicone	I	I	I	I	I	I	I	I	I	I	I	X

Source: E.H. Meyers' paper entitled "Incompatibility of Greases" 49th Annual NLGI Meeting

**C** = Compatible

**B** = Borderline Compatible

Typically results in a light softening or hardening of the NLGI Grade and a lowering of the dropping point of the mixture of grease.

**I** = Incompatible

Typically results in a softening or hardening of greater than 1 1/2 the NLGI grade, a shift in the dropping point, and a possible reaction of additives or base oils.

### Royal Purple Ultra-Performance® Grease Compatibility Chart

	Aluminum Complex	Barium	Calcium	Calcium 12-Hydroxy	Calcium Complex	Clay	Lithium	Lithium 12-Hydroxy	Lithium Complex	Polyurea	Silicone
Operating Temps. <225°F	C	C	C	C	C	I	C	C	C	C	I
Operating Temps. 225-350°F	C	B	B	C	B	I	B	B	C	B	I
Operating Temps. >350°F	C	I	I	C	I	I	I	I	C	I	I

**Note:** Ultra-Performance® greases are more stable. This chart is generated from independent lab testing and field experience. Actual compatibility results may vary. It is recommended that bearings be purged of old grease per OEM instructions to ensure proper lubrication and performance.

## GUIDE FOR COMPRESSORS IN GAS SERVICE

Royal Purple's line of specialty synthetic lubricants offers performance advantages in the lubrication of compressors in gas compression service.

### ROYAL PURPLE PRODUCT OVERVIEW

#### GENERAL LUBRICANTS

1. Synfilm NGL with Synerlec additive technology is formulated to prevent hydrocarbon dilution.
2. Synfilm GT with Synerlec additive technology, is a synthetic, high temperature compressor oil.
3. Acivac is an excellent lubricant/corrosion preventive in acidic environments.

#### NSF CERTIFIED LUBRICANTS

1. Crystal-Clear is NSF Certified for H1 service.

### PRODUCT APPLICATION GUIDE

#### I. CHEMICALLY REACTIVE—OXIDIZING GASES

Oxygen Chlorine Fluorine Bromine Nitrogen Oxide	These highly reactive gases will react with any carbon based oil; therefore, these compressors are either non-lubricated or use special oils. Royal Purple has no recommendation.
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#### II. CHEMICALLY REACTIVE—NON-OXIDIZING GASES

Hydrogen Chloride	1st choice	Acilube (in vacuum pump, use Acivac)
Hydrogen Sulfide	2nd	Crystal-Clear
Sulfur Dioxide		

#### III. INERT GASES OR REDUCING GASES

Nitrogen	1st choice	Synfilm NGL
Hydrogen	2nd	Synfilm GT
Helium	3rd	Crystal-Clear
Carbon Monoxide		
Carbon Dioxide		
Natural Gas		

#### Hydrocarbon gases such as:

Methane	1st	Synfilm NGL
Ethane	2nd	Synfilm GT
Propane	3rd	Crystal-Clear
Butane		
Pentane		

Methylene	1st	Crystal-Clear
Ethylene		
Propylene		
Butylene		
Acetylene		

#### IV. OTHER GASES

	1st	Synfilm NGL
	2nd	Synfilm GT

**Note:** Check lubrication recommendations in equipment manual for correct ISO viscosity grade. If any catalyst is used downstream of the compressor, check with Royal Purple's Industrial Tech. Department prior to product selection.

**Royal Purple's lubricants are saving individual companies millions of dollars a year in gas compressor service!**

## NSF-REGISTERED LUBRICANTS

### ROYAL PURPLE PRODUCT

### NSF REGISTRATION

Barrier Fluid FDA 22	H1
Barrier Fluid FDA 34	H1
Barrier Fluid FDA 56	H1
Barrier Fluid FDA 78	H1
Barrier Fluid FDA 910	H1
Poly-Guard FDA 32	H1
Poly-Guard FDA 46	H1
Poly-Guard FDA 68	H1
Poly-Guard FDA 100	H1
Poly-Guard FDA 150	H1
Poly-Guard FDA 220	H1
Poly-Guard FDA 320	H1
Poly-Guard FDA 460	H1
Poly-Guard FDA 1000	H1
Syndraulic 32	H2
Syndraulic 46	H2
Syndraulic 68	H2
Synfilm GT 32	H2
Synfilm GT 46	H2
Synfilm GT 68	H2
Synfilm GT 100	H2
Synfilm GT 150	H2
Synfilm GT 220	H2
Synfilm GT 320	H2
Synfilm GT 460	H2
Uni-Temp 300	H2

GRADE	AVAILABLE PACKAGING (SAP PART # / LEGACY PART #)				PAGE
<b>ALKALUBE 32</b>					
32	<b>320 Gal Tote</b> 301741175322 / 11449				<b>13</b>
<b>BARRIER FLUID® FDA</b>					
22	<b>320 Gal Tote</b> 300928175322 / 10117	<b>Drum</b> 300928175007 / 10114	<b>Pail</b> 300928175017 / 10118	<b>1-Gal Bottle</b> 300928175180 / 10121	<b>13</b>
34	<b>Drum</b> 301304175008 / 10125	<b>Pail</b> 301304175017 / 10128		<b>1-Gal Bottle</b> 301304175180 / 10122	<b>13</b>
56	<b>Drum</b> 301860175008 / 10131	<b>Pail</b> 301860175017 / 10134			<b>13</b>
78	<b>Drum</b> 301138175008 / 10138				<b>13</b>
910	<b>Drum</b> 301861175008 / 10142	<b>Pail</b> 301861175017 / 10145			<b>13</b>
<b>BARRIER FLUID® GT</b>					
22	<b>Drum</b> 301305175007 / 10149	<b>Pail</b> 301305175017 / 10152			<b>13</b>
34	<b>Bulk</b> 301862175345 / 11686	<b>320 Gal Tote</b> 301862175322 / 11454	<b>Drum</b> 301862175008 / 10157	<b>Pail</b> 301862175017 / 11384	<b>13</b>
34 DYED	<b>Pail</b> 301306175017 / 10160				<b>13</b>
56	<b>Drum</b> 301863175008 / 10161				<b>13</b>
78	<b>Drum</b> 301139175007 / 10163				<b>13</b>
910	<b>Drum</b> 301864175008 / 10166				<b>13</b>
<b>BIOMAX™ EAL GEAR OIL</b>					
100	<b>Drum</b> 301140175008 / 11817	<b>Pail</b> 301140175017 / 11816			<b>14</b>
150	<b>Drum</b> 301865175007 / 11819	<b>Pail</b> 301865175017 / 11818			<b>14</b>
220	<b>Drum</b> 301307175007 / 11821	<b>Pail</b> 301307175017 / 11820			<b>14</b>
320	<b>Drum</b> 300959175007 / 11833	<b>Pail</b> 300959175017 / 11832			<b>14</b>
460	<b>Drum</b> 301866175007 / 11835	<b>Pail</b> 301866175017 / 11834			<b>14</b>
680	<b>Drum</b> 301308175007 / 11837	<b>Pail</b> 301308175017 / 11836			<b>14</b>
<b>BIOMAX™ EAL HYDRAULIC OIL</b>					
22	<b>Drum</b> 301867175007 / 11862	<b>Pail</b> 301867175017 / 11861			<b>14</b>
32	<b>Drum</b> 301309175007 / 11843	<b>Pail</b> 301309175017 / 11842			<b>14</b>
46	<b>Drum</b> 300904175007 / 11811	<b>Pail</b> 300904175017 / 11810			<b>14</b>
68	<b>Drum</b> 301868175007 / 11813	<b>Pail</b> 301868175017 / 11812			<b>14</b>
<b>BIOMAX™ STERN TUBE EAL</b>					
100	<b>Drum</b> 302781175008 / 11894				<b>14</b>
150	<b>Drum</b> 302782175008 / 11895				<b>14</b>
<b>CAP™</b>					
700/460	<b>Bulk</b> 301872175345 / 10175	<b>Drum</b> 301872175008 / 10176			<b>15</b>
<b>CLEAN &amp; FLUSH™</b>					
46	<b>Drum</b> 301959175008 / 10355	<b>Pail</b> 301959175017 / 10357			<b>15</b>
<b>CMT™</b>					
30	<b>Bulk</b> 301076175345 / 10221	<b>320 Gal Tote</b> 301076175322 / 10224			<b>15</b>
50	<b>Drum</b> 301845175008 / 10229				<b>15</b>

GRADE	AVAILABLE PACKAGING (SAP PART # / LEGACY PART #)				PAGE
<b>COUPLING GREASE™</b>					
NLG11	<b>Cartridge</b> 301962175235 / RP1072-CS				<b>15</b>
<b>CRYSTAL-CLEAR®</b>					
40X	<b>Drum</b> 500259175008 / 10211	<b>Pail</b> 301842175017 / 10212			<b>16</b>
<b>CRYSTAL PURE®</b>					
1X	<b>Drum</b> 500190175007 / 10242	<b>Poly Drum</b> 500190175007			<b>16</b>
2X	<b>Drum</b> 301421175008 / 10252				<b>16</b>
40X	<b>320 Gal Tote</b> 301857175322 / 11513				<b>16</b>
60X	<b>Drum</b> 300963175008 / 10267				<b>16</b>
<b>DEZEL HI-BASE®</b>					
15W-40	<b>Drum</b> 301874175008 / 10292				<b>16</b>
<b>DURALEC™ SUPER MOTOR OIL</b>					
10W-30	<b>Drum</b> 301440490008 / 87456	<b>1-Gal Bottle</b> 301440490195 / 83456			<b>17</b>
15W-40	<b>320 Gal Tote</b> 300905490322 / 88154	<b>Drum</b> 300905490008 / 55154	<b>Pail</b> 300905490017 / 05154	<b>1-Gal Bottle</b> 300905490195 / 43154 <b>1-Qt Bottle</b> 300905490115 / 06154	<b>17</b>
<b>ENDURO-MP GREASE</b>					
NGLI 2	<b>Lined Drum</b> 301467175029 / 11764	<b>Keg</b> 301467175011 / 11765	<b>Pail</b> 301467175015 / 11766	<b>Cartridge</b> 301467175236 / 11763	<b>17</b>
<b>ESCALATOR CHAIN LUBE</b>					
N/A	<b>Pail</b> 301424175017 / 11542				<b>17</b>
<b>HD MOTOR OIL</b>					
SAE 30	<b>1-Qt Bottle</b> 301149175115 / 06030				<b>18</b>
SAE 40	<b>Drum</b> 301905175008 / 55040	<b>1-Qt Bottle</b> 301905175115 / 06040			<b>18</b>
SAE 50	<b>Pail</b> 301444175017 / 05050		<b>1-Qt Bottle</b> 301444175115 / 06050		<b>18</b>
SAE 15W-40	<b>320 Gal Tote</b> 301902175322 / 11565	<b>Drum</b> 301902175008 / 11564	<b>Pail</b> 301902175017 / 11563	<b>1-Gal Bottle</b> 301902175180 / 11561	<b>18</b>
<b>HP 2-C®</b>					
N/A	<b>1-Gal Bottle</b> 302011175195 / 43311	<b>1-Qt Bottle</b> 302011175115 / 06311			<b>18</b>
<b>HPS™</b>					
5W-20	<b>Drum</b> 301072175008 / 37520	<b>1-Qt Bottle</b> 301072175115 / 36520			<b>18</b>
5W-30	<b>Drum</b> 301150175008 / 37530	<b>Pail</b> 301150175017 / 35530	<b>1-Qt Bottle</b> 301150175115 / 36530		<b>18</b>
10W-30	<b>320 Gal Tote</b> 301899175322 / 39130		<b>Pail</b> 301899175017 / 35130	<b>1-Qt Bottle</b> 301899175115 / 36130	<b>18</b>
10W-40	<b>Drum</b> 301901175008 / 37140	<b>Pail</b> 301901175017 / 35140			<b>18</b>
20W-50	<b>Drum</b> 301443175008 / 37250	<b>1-Qt Bottle</b> 301443175115 / 36250			<b>18</b>
<b>HY-THERM™ 707</b>					
N/A	<b>Drum</b> 301878175007 / 10360				<b>19</b>



GRADE	AVAILABLE PACKAGING (SAP PART # / LEGACY PART #)		PAGE
<b>MARINE HYDRAULIC OIL</b>			
15	Drum 301886175008 / 10511		19
22	320 Gal Tote 301154175322 / 11544	Drum 301154175008 / 10512	19
32	Drum 301887175008 / 10514		19
46	Drum 301431175008 / 10518	Pail 301431175017 / 10520	19
68	320 Gal Tote 300966175322 / 10526	Drum 300966175008 / 10523	19
<b>MAX ATF®</b>			
N/A	Pail 301741175008 / 05320	1-Qt Bottle 301143175115 / 06320	20
<b>MAX-CHAIN®</b>			
N/A	Pail 301892175017 / 10542	Aerosol 500133175261 / 05330	20
<b>MAXFILM®</b>			
N/A	Pail 301434175017 / 10534	Aerosol 500262175261 / 05000	20
<b>MAX-GEAR®</b>			
75W-90	Pail 301894175017 / 05300	1-Qt Bottle 301894175115 / 06300	20
75W-140	Pail 301070175017 / 05301	1-Qt Bottle 301070175115 / 06301	20
80W-90	Pail 301437175017 / 05302		20
85W-140	1-Qt Bottle 301146175115 / 06303		20
<b>MAX-TUFF™</b>			
N/A	8 oz Bottle 301451175046 / 01335		21
<b>NGL-NS™</b>			
220	Drum 301917175008 / 10567		21
<b>PAPER MILL GREASE</b>			
NLGI 1.5	Keg 301965175011 / 11342	Cartridge 301965175235 / 11340	21
<b>POLY-GUARD® FDA</b>			
15	Drum 301939175008 / 10629		22
22	Drum 301940175008 / 10638	Pail 301940175017 / 10639	22
32	Drum 300912175008 / 10648	Pail 300912175017 / 10651	22
46	Drum 301512175008 / 10658	Pail 301512175017 / 10660	22
68	Drum 301251175008 / 10666	Pail 301251175017 / 10667	22
100	Drum 301510175008 / 10623	Pail 301510175017 / 10624	22
150	Drum 301250175008 / 10627		22
220	Drum 301511175008 / 10634	Pail 301511175017 / 10635	22
320	Drum 301941175008 / 10642		22
460	Drum 301942175008 / 10654	Pail 301942175017 / 10655	22
680	Drum 301943175008 / 10661		22

GRADE	AVAILABLE PACKAGING (SAP PART # / LEGACY PART #)		PAGE		
<b>QUADREX®</b>					
40	320 Gal Tote 301946175322 / 10698	Drum 301514175008 / 10688	22		
<b>SYNDRAULIC®</b>					
32	Drum 301470175008 / 10002		23		
46	Bulk 301265175345 / 11422	320 Gal Tote 301265175322 / 10005	Drum 301265175008 / 10007	23	
68	Drum 301471175008 / 10012		23		
150	320 Gal Tote 300972175322 / 10776		23		
<b>SYNERGY®</b>					
100	Drum 302000175008 / 11059		23		
150	320 Gal Tote 301488175322 / 11073	Drum 301488175008 / 11070	23		
220	320 Gal Tote 302001175322 / 11083	Drum 302001175008 / 11080	Pail 302001175017 / 11085	23	
320	Bulk 302002175345 / 11016	320 Gal Tote 302002175322 / 11021	Drum 302002175008 / 11018	23	
460	Drum 301275175008 / 11029		23		
680	Drum 301490175008 / 11036		23		
<b>SYNERGY® WORM GEAR</b>					
680	Drum 301492175008 / 11107		24		
1000	Pail 301491175017 / 11091		24		
<b>SYNFILM®</b>					
N/A	2 oz Bottle 300867175066 / 02514		24		
32	320 Gal Tote 301473175322 / 10827	Drum 301473175008 / 10825	Pail 301473175017 / 10828	1-Qt Bottle 301473175125 / 10819	24
32 NO DYE	320 Gal Tote 301978175322 / 10832	Drum 301978175008 / 10830	Pail 301978175017 / 10833	24	
46	Drum 301267175008 / 10838	Pail 301267175017 / 10841		24	
68	Drum 301474175008 / 10025	Pail 301474175017 / 10028	1-Qt Bottle 301474175125 / 10031	24	
68 NO DYE	Drum 300973175008 / 10849	Pail 300973175017 / 10851		24	
100	Drum 301974175008 / 10789	Pail 301974175017 / 10790		24	
100 NO DYE	Pail 301266175017 / 10795			24	
150	Drum 301975175008 / 10799	Pail 301975175017 / 10802		24	
150 NO DYE	320 Gal Tote 301976175322 / 10806			24	



GRADE	AVAILABLE PACKAGING (SAP PART # / LEGACY PART #)			PAGE
<b>SYNFILM® GT</b>				
22	Drum 301983175008 / 10886			24
32	Drum 301985175008 / 10905	Pail 301985175017 / 10910		24
32 NO DYE	320 Gal Tote 301479175322 / 10913	Drum 301479175007 / 10912		24
46	320 Gal Tote 301987175322 / 10933	Drum 301987175008 / 10932	Pail 301987175017 / 10934	24
46 NO DYE	320 Gal Tote 301480175322 / 11695			24
68	320 Gal Tote 301013175322 / 10946	Drum 301013175007 / 10945	Pail 301013175017 / 10947	24
68 NO DYE	320 Gal Tote 301990175322 / 11696	Drum 301990175008		24
100	320 Gal Tote 301981175322 / 10856	Drum 301981175008 / 10854	Pail 301981175017 / 10858	24
100 NO DYE	320 Gal Tote 301268175322	Drum 301268175008 / 10859		24
150	320 Gal Tote 301982175322 / 11398	Drum 301982175008 / 10870	Pail 301982175017 / 10873	24
220	320 Gal Tote 301477175322 / 10895	Drum 301477175008 / 10894	Pail 301477175017 / 10897	24
			1-Gal Bottle 301477175180 / 10890	
320	Drum 301478175008 / 10922	Pail 301478175017 / 10924		24
320 NO DYE	320 Gal Tote 300868175322			24
460	Drum 301270175008 / 10939	Pail 301270175017 / 10941		24
680	Drum 301989175008 / 10949			24
<b>SYNFILM® GT WIND GEAR 320</b>				
320	Drum 500202175008 / 11576	Pail 500215175017 / 11575		25
<b>SYNFILM® NGL</b>				
46	Drum 301484175008 / 10980			25
100	320 Gal Tote 301482175322 / 10959	Drum 301482175008 / 10957		25
150	320 Gal Tote 301992175322 / 10968	Drum 301992175007 / 10966	Pail 301992175017 / 10969	25
150 NO DYE	320 Gal Tote 301483175322 / 10972			25
220	Drum 301993175008 / 10974			25
<b>SYNFILM® RECIP</b>				
100	Drum 301996175008 / 55513	1-Gal Bottle 301996175180 / 04513	1-Qt Bottle 301996175115 / 06513	26
150	Drum 301997175008 / 11006			26
<b>THERMASIL™ T-100</b>				
NLGI 0	Pail 301008175015 / 11263			26
<b>THERMAX™ 680 GREASE</b>				
NLGI 2	Keg 301465175011 / 10055	Pail 301465175015 / 10056	Cartridge 301465175235 / 10051	26
<b>THERMYL-GLYDE®</b>				
220	Drum 301017175008 / 11193	Pail 301017175017 / 11195		27
320	Drum 301499175008 / 11200			27
460	Drum 302017175008 / 11211			27
680	Pail 301501175017 / 11220			27
1000	Drum 300869175008 / 11183			27
1500	Drum 302013175008 / 11188			27

GRADE	AVAILABLE PACKAGING (SAP PART # / LEGACY PART #)			PAGE
<b>THERMYL-GLYDE® WORM GEAR OIL</b>				
460	Drum 301502175008 / 11238			27
680	Drum 301018175008 / 11243			27
<b>THERMYL-TUFF™</b>				
200	Drum 301948175002 / 11271	Pail 301948175017 / 11273		28
300	Drum 301019175002 / 11275	Pail 301019175017 / 11277		28
<b>TUFF COAT M</b>				
N/A	Lined Drum 301466175029 / 11176			28
<b>ULTRA-PERFORMANCE® GREASE</b>				
NLGI 1	Pail 301007175015 / 10072	Cartridge 301007175235 / 10069		28
NLGI 2	Lined Drum 301961175029 / 55312	Keg 301961175011 / 16312	Pail 301961175015 / 35312	28
			Cartridge 301961175235 / 01312	
<b>UNI-TEMP™</b>				
300	Drum 301951175008 / 11351			29
<b>VP™ PRESERVATIVE OIL 10</b>				
N/A	Drum 301506175008 / 11369	Pail 301506175017 / 11370		29
<b>WIRE ROPE LUBRICANT</b>				
N/A	Pail 301283175017 / 11377			29



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