

**RED LINE SYNTHETIC MOTOR OILS** are designed to provide the highest degree of protection and cleanliness for your engine. We use the most stable synthetic components available and formulate our products for wear protection across a wide range of operating conditions. Red Line lubricants contain polyol ester basestocks, the only lubricants which can withstand the tremendous heat of modern jet engines, which makes our motor oil a necessity to properly lubricate a turbocharger or hot-running engine. The synthetic basestocks have a natural multigrade property, which means that large amounts of unstable polymeric thickeners are not required to manufacture our multigrades. Red Line Synthetic Motor Oils will provide better protection than a petroleum oil of the next higher viscosity grade under high shear conditions.

#### BENEFIT SUMMARY

- Formulated for turbo protection
- Provides upper cylinder wear protection
- Increases high-temperature oil pressure
- Protects bearings at high speeds and temperatures
- Prevents foaming even at high speeds
- Reduces engine temperatures
- Flows well in very cold climates
- Compatible with petroleum and synthetic oils
- Compatible with seals designed for petroleum
- Recommended where the following are required:  
API SJ/SH/SG/SF/CF-4/CE/CD/CC
- Allows extended drains in non-warranty vehicles

#### IMPROVED HIGH RPM PROTECTION

The viscosity seen in a bearing or cam may be completely different than the labeled viscosity. Petroleum oils lose considerable viscosity at high RPMs and high temperatures. In contrast, Red Line synthetics are much more resistant to viscosity loss than even the best petroleum oils. A petroleum 20W50 begins as a 20W oil and the oil is thickened with a polymeric plastic substance which will thicken the oil at higher temperatures. Unfortunately, when the oil enters a high shear stress area such as a bearing, these large polymer molecules align themselves in order to create the path of least resistance. As shown in Figure 1, the apparent viscosity can be much less than the viscosity listed on the container - typical 20W50s

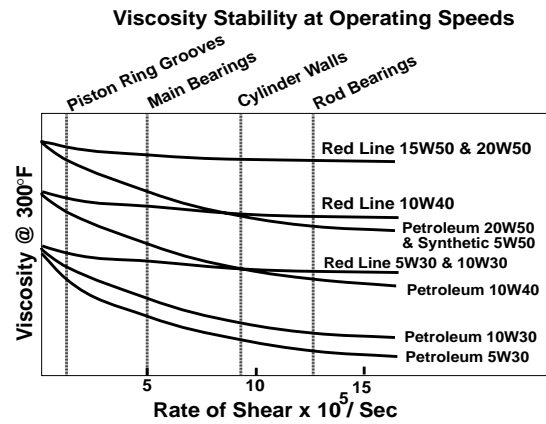


Figure 1: Red Line 10W40 provides greater bearing protection than petroleum 20W50s. Note how even high-quality petroleum oils will lose a significant portion of their viscosity protection when exposed to the high shear forces in bearings and on cylinder walls.

#### HIGHER VISCOSITY IN BEARINGS AND CAMS

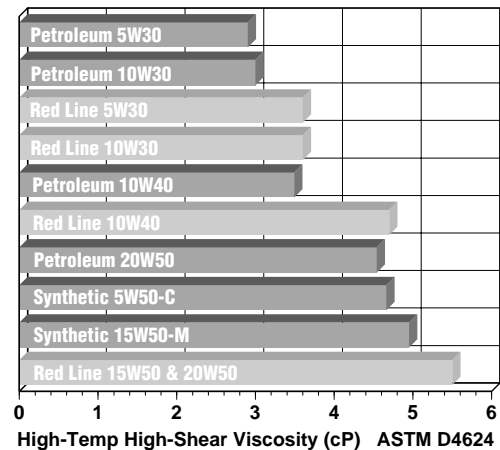


Figure 2: Red Line provides significantly greater viscosity than petroleum oils under high-speed and high temperature conditions. Red Line provides a greater viscosity than the next higher petroleum grade.

will actually be similar to an SAE 30 or 40 in the bearing. The same behavior occurs with all multigrades, with a petroleum 5W30 shearing down to a 10W or 20W and a synthetic 5W50 shearing similarly to a petroleum 20W50. No wonder 5W30s

are not recommended for sustained high-speed driving.

These polymeric thickeners are very large molecules which will suffer from thermal cracking when exposed to high temperatures. When these molecules crack, they reform to create varnish deposits which can stick rings and plug turbo passages. For this reason many turbocharged cars recommend against using wide-range multigrades. Since Red Line Synthetic Oils satisfy the high-temperature and low-temperature flow requirements of a multigrade using only a fraction of these thickeners, all viscosity grades are suitable for high temperature and turbo use.

#### BETTER HIGH TEMPERATURE LUBRICATION

Petroleum oils boil away rapidly or decompose under high temperature conditions. The low volatility of Red Line not only reduces oil consumption, but it can have a significant effect on upper cylinder lubrication, especially in the upper ring area which will see temperatures in the range of 600°F, temperatures where polyol ester basestocks will provide excellent lubrication. Cam and follower contacts can also reach temperatures of 500°F. Modern engines are designed to run much hotter than their predecessors, producing more power out of smaller engines. The engine compartments contain much more insulation to deaden noise. The air flow through the engine compartment has been reduced in order to reduce air drag and improve fuel economy. Petroleum oils may have adequately lubricated automotive engines of the past, but new engine designs are creating much more stress on the oil. The thermal stability of the synthetic hydrocarbon used in other synthetics is only slightly greater than a petroleum hydrocarbon molecule; however, the polyol esters in Red Line are capable of at least an additional 100°F before breakdown.

#### BETTER OXIDATION STABILITY

Conventional petroleum oils break down when exposed to oxygen at the high temperatures. Even though the temperature in the sump may not be excessive, the oil which coats the cylinder walls sees oxygen under high temperatures and pressures, an environment which promotes oxygen attack. The reaction products are initially organic acids, which are corrosive to metals. These acids

will combine to form varnish deposits which will coat metal, reducing the ability to transfer heat, and will build up in the ring area causing ring sticking. Excessive oxidation results in oil thickening. A significant advantage of a synthetic such as Red Line is the much better resistance to oxidation. Red Line begins with basestocks which have been designed for excellent stability.

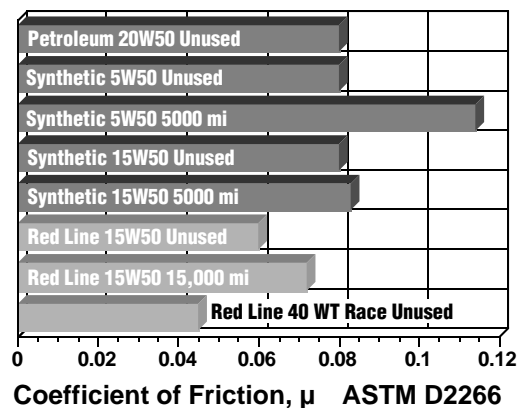
#### EXCELLENT ENGINE CLEANLINESS

In addition to excellent control of varnish deposits, Red Line Synthetic lubricants can prevent sludge deposits. The high temperature stability insures that there is less contribution to sludge from oxidized oil, but the unburned fuel components still can contribute to sludge and varnish formation. Well-tuned engines which regularly attain the operating temperature regulated by the cooling system have no problems with partially-burned fuel, but engines driven only a few miles at a time can build up sludge rapidly. Red Line uses large amounts of dispersant chemistry which encircle the combustion particles and prevent them from coagulating with others and settle out in the lubrication system. This dispersancy and detergency makes Red Line Synthetic Oils truly long-drain oils.

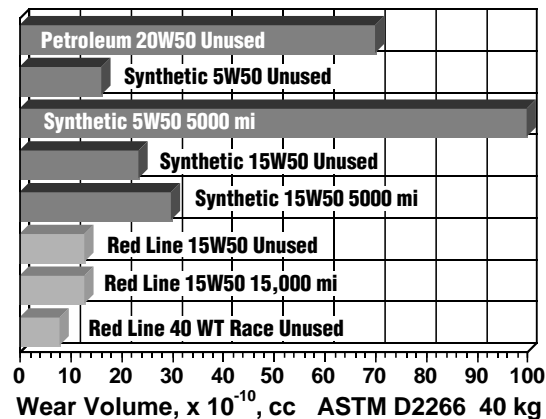
#### WEAR PREVENTION

Not all synthetics are created equal! If metal-to-metal contact does occur, the amount of friction created can make a great difference whether the bearing will spin or the cam and follower will create tremendous heat and wear. The chart on the following page indicates that Red Line lubricants provide significantly lower friction. Compared are several "high-performance" synthetic and petroleum lubricants. This reduced friction means less heat is generated, so temperatures are reduced and more power is transferred to the wheels. Red Line lubricants also provide excellent wear protection. Red Line provides several different antiwear additives in each lubricant to provide wear protection over a very wide range of conditions. The data from two ASTM Steel-on-Steel wear tests on the following page indicate that Red Line has a distinct ability to carry a greater load and that less wear is produced per unit of load. The Moderate Load chart indicates the ability of Red Line to significantly reduce wear under normal loads which are encountered. The Heavy Loads chart indicates

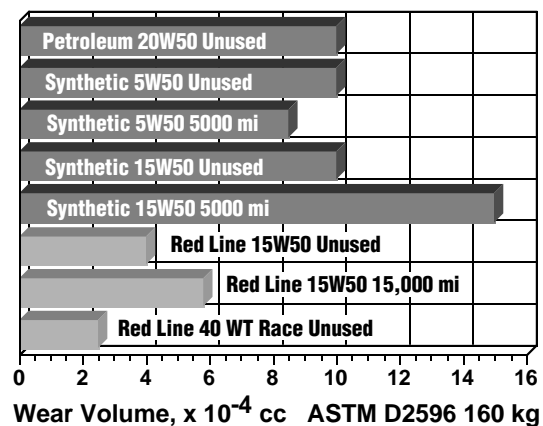
### REDUCED FRICTION



### REDUCED WEAR AT MODERATE LOADS



### REDUCED WEAR AT HEAVY LOADS



that Red Line provides less wear under severely loaded conditions encountered in high-performance applications. Note how even after 15,000 miles Red Line outperforms even new petroleum and synthetics, and the friction and wear characteristics of some other synthetics is significantly lower after 5,000 miles use. All Red Line Motor Oils will provide similar low friction and wear. Red Line contains unique oxidation inhibitors which are converted to antiwear additives as they absorb oxidizers, constantly replenishing the antiwear chemistry. The reduced friction indicates a product which is superior to other commercially available petroleum and synthetic lubricants. This translates into excellent protection and more power to the wheels.

#### FOAM PREVENTION

Lubricating with tiny air bubbles is a very difficult task. Many engine noises and engine failures can be attributed to excessive foaming. Red Line Synthetic oils have been formulated to resist foam in even the most severe racing engines.

#### VISCOSITY GRADE SELECTION

The proper viscosity grade to use depends on many factors such as ambient temperature, miles on the engine, bearing and piston clearances, and type of service. A general rule of lubrication is to use the lowest viscosity possible which will provide the proper separation of metal. Anything more than this minimum will increase power loss due to friction and will reduce the pumpability of the oil at all temperatures. However, one must consider synthetics differently when determining viscosity requirements. At high speeds, a petroleum 5W30 can appear to be a 15W in the bearings due to the shear stress, yet Red Line 5W30 will actually be an SAE 30 in the bearings. There is a significant difference in lubricating an engine with a 30 compared to a 15W. Red Line Synthetic oil will provide better viscosity protection than the next higher petroleum viscosity grade. If clearances are tight and very little lugging occurs, then the 5W30 or 10W30 should be adequate. Less turbo lag will be noticed with the 5W30. If ambient temperatures will regularly climb above 100°F, then the 10W40 would provide an additional safety margin. If the engine is air-cooled, or if the engine is older and has greater bearing and ring clearances, the

15W50 and 20W50 will develop a thicker oil film. If very low temperatures occur, the lower viscosity grades, (5W30, 10W30, or 10W40) will flow better and lubricate the engine more quickly after start-up.

#### DRAIN INTERVALS

Red Line stands alone in the ability to provide extended drain intervals and lower friction and wear. Red Line Synthetic oils have been shown to last 25,000 miles in field tests; however we recommend shorter drain intervals in order to provide a margin of safety with the oil. We recommend draining the oil between 12,000 and 18,000 miles depending on the type of service and the degree of blow-by gases contaminating the oil. High-speed freeway driving is easy on the oil due to its excellent thermal stability. If the engine is worn and if considerable stop-and-go driving is involved, 10,000-12,000 mile drains are suggested. A good rule of thumb to follow is to change the oil at least once a year regardless the mileage. Manufacturers warranty requirements should be followed while under warranty. Filters can be changed every 7,500 to 10,000 miles in order to assure filter durability is not a problem.

Red Line makes a 15W40 Diesel Engine Oil for diesel engines. The diesel engine oils contain significantly greater detergency and total base number (TBN) which helps keep the engine clean. This additional detergency is not recommended for gasoline engines since it could increase the tendency for spark plug fouling. Even though the Red Line Motor Oils meet the specifications for diesel engines, the Diesel Engine Oil should be used where extended drains (10,000 miles +) are required.

#### RACE OILS

Red Line has a complete line of race oils strictly for use in racing applications. They differ from the Motor Oils in that they contain no detergents and consequently have a slightly better ability to reduce friction, but they are not suitable for long-term street use which sees some low-temperature operation. Red Line Motor Oils still provide lower friction than other commercial lubricants. Race Oils are available as 2WT, 5WT (0W), 10WT (0W10), 20WT (5W20), 30WT (10W30), 40WT (15W40), 50WT (15W50), 60WT (20W60).

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# RED LINE<sup>®</sup>

# SYNTHETIC

# MOTOR OILS

## TECHNICAL

## INFORMATION

Red Line Synthetic Oil Corp.  
6100 Egret Court, Benicia, CA 94510  
(707) 745-6100  
www.redlineoil.com