



RED LINE SYNTHETIC OIL CORP.

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Synthetic Two-Cycle Lubricants

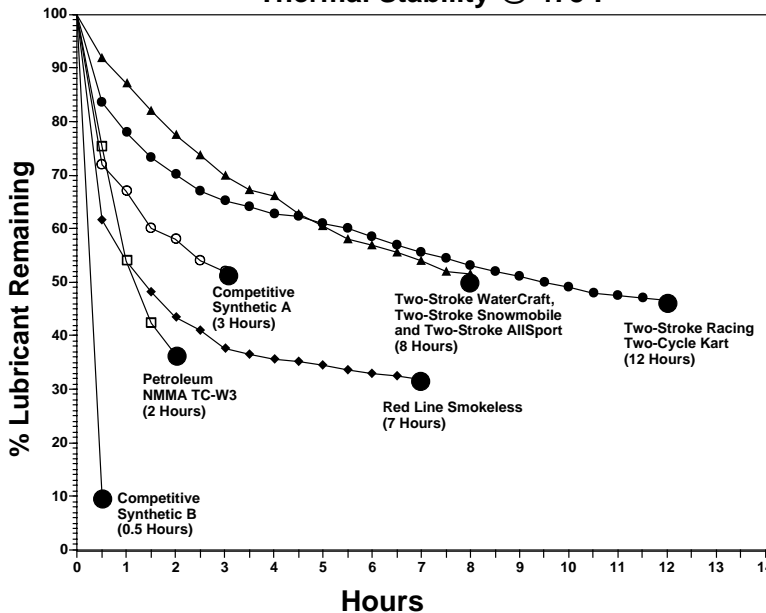
All Red Line Two-Cycle lubricants are designed to provide the greatest protection and the maximum power from a two-cycle engine. Red Line has many different two-cycle lubricants which vary in lubricity, thermal stability, and ash-containing or ashless detergent type. The greatest degree of cleanliness and lubricity is provided by our Two-Stroke Racing Oil. The Two-Stroke Racing Oil provides the cleanest and best lubricity, which is far superior to castor bean oil, petroleum, and other synthetics. This lubricant provides excellent lubricity and perfect cleanliness even in race engines operating at 15,000 rpms. But not every engine has such demanding requirements. That is why we have many other two-cycle lubricants to lubricate factory stock or slightly modified engines with a less costly product without making any compromise in durability. The main difference in our two-cycle lubricants is the temperature stability of the basestocks used. The more thermally-stable the basestock, the higher the cost of the lubricant, with the Two-Stroke Racing Oil product being the cleanest and most thermally stable product on the market and the Smokeless being the least thermally stable within our product line. However, all of these synthetic lubricants provide better cleanliness, better protec-

tions to assist in the prevention of piston scuffing. A competitive synthetic two-cycle (B) showed very little deposit formation upon heating, but evaporated very quickly, with little lubricant remaining at temperatures found in the ring area. Another did not evaporate as quickly and would provide better scuff protection than petroleum, but has relatively poor ability to prevent ring stick. Red Line lubricants are extremely clean and data below demonstrates that Red Line lubricants provide better scuff protection and reduced bearing and ring wear. Red Line can provide both better cleanliness and reduced wear.

Two-Stroke Racing Oil / Two-Cycle Kart Oil - provides excellent cleanliness and lubricity to keep even the highest-revving engines perfectly lubricated. Terry Ives Industries obtained perfect engine condition in their 100cc Yamaha KT-100 school karts after 25 hours of use. In this same type engine under 3 hours of competition at 20:1, the piston clearance increased only 0.00025 inch. Racing castor would provide between 0.001-0.002 inch wear under the same conditions. No ring, ring land, or cylinder wall wear was apparent in this 3 hour engine and skirt scuffing was virtually eliminated. In the Rotax 256 In-line Twin and the 125 Single the results were equally impressive. No obvious wear could be seen and skirt scuffing was virtually eliminated. No carbon deposits were formed and all combustion residue was easily wiped clean. Plug life is greatly extended. Emmick Enterprises obtained similar results in a Yamaha KT-100 which operates in the 350°-420°F cylinder head temperature range and up to 15,000 rpms. No scuffing and very low wear were observed after 7 hours of competition. A measurement of the lower-end bearing indicated that Two-Stroke Racing Oil provided less wear after 7 hours than racing castor or other synthetics after only 45 minutes. Many kart racers report that they can operate their engines at temperatures of 25°F greater than when using racing castor or other synthetics, without fear of piston sticking, enabling a considerable increase in power to be obtained. Two-Stroke Racing Oil is also exceptionally clean and this cleanliness makes it an extremely popular lubricant for jet skis, where it provides very crisp throttle response, up to 2-3% improvement in power, and will not leave a sticky residue in expansion chambers, waterboxes, or down the sides of the ski. We have several years experience with this oil in V-6 outboard racing in Champ Boats and Off-shore racing where it provides improved power, half the wear of other high-quality oils, and perfect cleanliness in even endurance racing. Dyno tests have shown 2-3% improvement in power, using a fresh engine, but the actual improvement is considerably greater compared to other lubricants. As the engine wears and develops deposits which restrict ring mobility and increase backpressure in the exhaust, the power output declines. But with Red Line Two-Stroke Racing Oil the reduced wear keeps the engine fresh and the complete absence of deposits keeps power output high. Two-Stroke Racing Oil can be used as a premix or as an injection oil.

Watercraft Injection Oil - is a high-performance all-synthetic formula which is designed to provide maximum power and the greatest protection and cleanliness in watercooled two-cycle engines which recommend an NMMA TC-W3 lubricant. The synthetic ester basestocks are biodegradable as determined by tests acceptable to European and American Environmental Agencies, providing significantly less water pollution than petroleum two-cycle lubricants. This lubricant also has excellent high temperature stability - much more stable than petroleum TC-W3

Thermal Stability @ 475°F



tion, and burn cleaner than any petroleum or other synthetic product available. Many engines will not see the extreme temperatures encountered in racing situations and can be perfectly lubricated with the Two-Stroke AllSport™ Oil, Watercraft or Snowmobile lubricants - leaving no piston deposits. The Two-Stroke Racing Oil will tolerate temperatures approximately 100°F greater than the Smokeless Oil and provides perfect cleanliness in even the most extreme applications. The graph above demonstrates the cleanliness capability of Red Line lubricants compared to a high-quality petroleum NMMA TC-W3 lubricant and other synthetics. The chart above indicates the evaporation rate of different lubricants at 475°F. The time indicated is the time required for the lubricant to decompose to a sticky mass capable of sticking a two-cycle piston ring.

The NMMA TC-W3 lubricant is a baseline with which to judge the Red Line lubricants. All Red Line lubricants provide significantly better stability than the petroleum reference. This indicates that Red Line lubricants will withstand the higher temperatures found in racing two-cycle applications and will also leave more lubricant on the cylinder

oils or other types of synthetics - providing less smoke, cleaner spark plugs, and cleaner pistons. These basestocks are combined with ashless deposit control and anti-scuff additives to prevent ring-sticking and scuffing under extreme temperatures and keep the piston and exhaust ports clean. The slipperiness of Red Line Watercraft Injection Oil can produce up to 3% more power and can provide significantly longer bearing life than when using NMMA TC-W3 Oils or other synthetics, even in oxygenated reformulated gasolines. Red Line can be used as an injection or premix oil and will dissolve in gasoline and remain soluble indefinitely. The rust protection of this product is far superior to BIA or NMMA lubricants which makes it suitable for marine use. This can be used in any two-cycle outboard engine up to 10,000 rpms.

Two-Stroke AllSport™ - is a high-performance all-synthetic formula which is designed to provide maximum power and the greatest protection and cleanliness in watercooled and air-cooled two-cycle engines. The properties are the same as with the Watercraft Oil above, but uses a low-ash chemistry which provides better cleanliness in higher temperature air-cooled engines, while the Watercraft Oil provides better cleanliness in lower-temperature water-cooled engines. Recommended for high-performance stock or slightly modified engines and where ISO GD, JASO FC, or API TC lubricants are recommended, but is not designed for outboard use. Red Line AllSport™ Oil may be run in ratios between 16:1 and 100:1, depending on rpms and engine manufacturer requirements.

Two-Stroke Snowmobile - same properties as AllSport™ with low-temperature capability below -40°F (-40°C).

Two-Stroke Smokeless - is a high-performance synthetic formula which is designed to reduce exhaust smoke. All Red Line two-cycle lubricants produce very low smoke, but with Smokeless it is virtually non-existent. The synthetic basestocks completely thermally decompose in the combustion process, helping to reduce petroleum pollution. This lubricant also has excellent high temperature lubricating ability - much better than petroleum and many other synthetics - providing less smoke, and clean spark plugs, pistons, and power valves. These basestocks are combined with low-ash deposit control and anti-scuff additives to prevent ring-sticking and scuffing under extreme temperatures and keep the piston and exhaust ports clean. The slipperiness of Red Line Smokeless Oil can produce more power and can provide significantly longer bearing life than when using manufacturer's oils or other synthetics, even in oxygenated gasolines. The low-ash chemistry provides better cleanliness in higher temperature air-cooled engines. The thermal stability graph shows the Smokeless providing better cleanliness than petroleum lubricants and it also provides significantly better scuff protection, but for significantly improved power production any of the other Red Line two-cycle lubricants are superior. This lubricant also has excellent high temperature stability - much more stable than petroleum or other types of synthetics - providing less smoke, and cleaner spark plugs. Recommended for high-performance stock or slightly modified engines and where ISO GD, JASO FC, or API TC lubricants are recommended, but is not designed for outboard use.

Two-Cycle Alcohol Premix - contains the same lubricating properties as Red Line Two-Stroke Racing Oil, but does not contain the detergents designed for gasoline engine cleanliness. Due to the clean-burning properties of methanol, the cleanliness in a methanol-burning engine would be comparable to the Two-Stroke Racing Oil. Two-Cycle Alcohol Premix is generally used at leaner fuel:oil mixtures than used in gasoline engines because of the greater fuel:air ratios used with methanol. This is an excellent product for model engines which use alcohol/nitro fuels, providing excellent cleanliness and wear protection.

New Ring Seating - Red Line Two-Stroke Racing Oil generally should not be used to seat a new ring because of the extreme slipperiness of the lubricant. A petroleum two-cycle lubricant used at normal loads for 15 minutes should be adequate for ring seating. Red Line Two-Stroke Oils can be used for ring seat if the engine is operated at 80% load for 15 minutes immediately after start up. Red

Line is compatible with petroleum lubricants, so system flushing is not necessary.

Compatibility - Red Line Two-Cycle lubricants are compatible with petroleum, castor and most synthetic lubricants. They may be mixed together in concentrated form or the fuel without separation or gel formation.

Rust Prevention - all Red Line Two-Cycle lubricants are designed to provide greater rust protection than required for BIA certification. The rust protection in Red Line two-cycle lubricants make them suitable for fresh-water or marine use.

Biodegradability - the synthetic lubricants used in Red Line products are more biodegradable than petroleum-based lubricants.

Fuel Stability - Red Line Two-Cycle lubricants will dissolve in gasoline at ratios of at least 15:1 and will not separate in even freezing conditions. Red Line Two-Cycle Alcohol is soluble in methanol at ratios of up to 5:1 at 70°F and 15:1 at 32°F. Red Line Two-Cycle lubricants will help stabilize fuels and prevent rust for seasonal storage.

Mix Ratios - proper mix ratios should be determined by the engine builder for the application being considered. Choosing the proper ratio depends on bearing and piston design, piston clearance, rpms, and air:fuel ratio. Higher rpm engines and those operating at high cylinder head temperatures require more oil in the fuel to maintain proper lubrication. When switching to Red Line Oil, begin with the same ratio at which other lubricants have operated successfully. Red Line Two-Cycle lubricants will allow the leanest oil:fuel ratio of any product on the market. If other lubricants have successfully operated at, for example, 100:1, then the Red Line lubricant for that application can also be used at the same ratio. After reviewing the performance at a given ratio, the amount of oil can be reduced slightly, to determine whether the reduced ratio is satisfactory or whether additional decreases can be achieved. A significant advantage of the Red Line Two-Cycle lubricants is that rich fuel:oil mixtures can be used without significantly altering the combustion characteristics of the fuel and still provide excellent throttle response. As a starting point, the Two-Cycle Kart Oil is generally operated at ratios between 16:1 to 32:1. The Two-Stroke Racing Oil is used at mixtures of 24:1 to 32:1 for 9,500 rpm outboard race motors, 50:1 for high-output operation, and up to 100:1 if the engine is properly designed for reduced oil mixtures. The Two-Stroke Watercraft Oil, Two-Stroke AllSport™, and Two-Stroke Smokeless can also be operated at ratios between 24:1 and 100:1, depending on the designed lubricating requirement.

Summary of Two-Cycle Recommendations

Two-Stroke Racing Oil / Two-Cycle Kart Oil (they are both the same chemistry) - for highly modified racing engines which turn high rpms, such as racing motorcycles, karts, personal watercraft, snowmobiles, and highly modified outboards.

Two-Stroke Watercraft Oil - for stock to moderately modified outboards and personal watercraft where NMMA TC-W3 or any TCW lubricant or other ashless lubricant is recommended.

Two-Stroke AllSport™ Oil - for stock to moderately modified motorcycles, snowmobiles, garden equipment and chainsaws or any two-cycle engine which recommends a low-ash type of lubricant.

Two-Stroke Smokeless - for stock two-cycle equipment which requires low-ash chemistry and there is a desire to completely eliminate smoke.

Two-Stroke Snowmobile - for stock to moderately modified snowmobiles which require very low-temperature pumpability.