PRODUCT INFORMATION SHEET

WYNN'S HEAVY DUTY CONCENTRATE FOR ENGINES

Product Number: 53362 2 x 5 litre

WYNN'S HEAVY DUTY CONCENTRATE FOR ENGINES is a blend of scientifically formulated compounds such as corrosion inhibitors, oxidation inhibitors, detergents/dispersants and acid neutralisers combined with the unique Wynn's Friction Proofing Package. They collectively form a product capable of reducing maintenance costs by improving engine cleanliness, reducing wear and providing extremely high levels of protection, beyond the capability of API-CH4 performance.

Advantages

The compounds formulated in Wynn's Heavy Duty Concentrate for Engines provide the following benefits.

- OXIDATION INHIBITORS prevent the premature oxidation or breakdown of mineral oils. Excessive heat combined with severe agitation of crankcase lubricants act as catalysts for premature oil oxidation. Wynn's Heavy Duty Concentrate for Engines replenishes or boosts the level of inhibitors thereby retarding oil thickening and subsequently extending oil service life.

- DETERGENTS/DISPERSANTS improve engine cleanliness under all operating conditions. As ordinary engine oils suffer contamination and therefore a depletion of dispersant additives, Wynn's Heavy Duty Concentrate for Engines restores engine cleanliness, thereby extending oil and engine life through reduced abrasive particle contributed wear.

- ANTI-WEAR ADDITIVES in the unique Wynn's Friction Proofing are chemical compounds designed to treat metal surfaces which suffer extreme pressure, excessive loads and high frictional stress. This molecular bonding serves as protection against wear, reduces oil temperature and therefore extends oil service and engine life.

Wynn's Heavy Duty Concentrate for Engines is an engine oil treatment scientifically formulated to provide extra protection under heavy duty operating conditions.

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Additional features of Wynn's Heavy Duty Concentrate for Engines are:-

- Improved corrosion control.
- Cleaner engines.
- Less wear over all engine speeds.
- Reduced smoke emissions.
- Quieter engine operation.
- Increased engine efficiency.
- Longer oil life.

Wynn's Heavy Duty Concentrate for Engines boosts engine performance to the latest industry standards. It improves the soot handling capabilities of diesel engine oils, key in today's engine with retarded timing.

Benefits

Wynn's Heavy Duty Concentrate for Engines has been formulated to provide the following benefits:-

- Maintains engine cleanliness.
- Disperses crankcase contaminants.
- Prevents bearing corrosion.
- Retards oil oxidation.
- Prevents sulphur corrosion.
- Reduces friction and wear on metal surfaces.
- Prevents soot induced thickening.
- Reduces bore polish.

Wynn's Heavy Duty Concentrate for Engines provides performance beyond API CH-4/CG-4/CF-4/SJ.

Applications

Wynn's Heavy Duty Concentrate for Engines is suitable for all types of petrol and diesel engines in road transport, agriculture, earthmoving, mining, marine and manufacturing industries.

At 5% volume dosage level, Wynn's Heavy Duty Concentrate for Engines will improve performance beyond the API CH-4/CG-4/CF-4/SJ Standards. Existing engine oils with the following performance capabilities will gain the following improvement when dosed at 5% volume with Wynn's Heavy Duty Concentrate for Engines.

Standard	Performance Capability Improvement	
	Engine Oil	+ 5.0% HDCE
API	CH-4/CG-4/CF-4/SJ	CH-4/CG-4/CF-4/SJ
ACEA	E2/B3/A2	E3/B3/A3
Cummins CES	20071	20071/20072
Mack	EO-M	EO-M
Mercedes Benz	228.1/MTU	228.3/MTU
Volvo	VDS	VDS-2

This product will improve performance and extend oil change periods in all conventional mineral oils in diesel or petrol engines.

This product is not recommended for use in vegetable or synthetic oils, such as glycols and esters, which are incompatible with mineral base oils. Wynn's Heavy Duty Concentrate for Engines is compatible with synthetic oils that are based on polyalphaolefin hydrocarbon blends. Although it has been formulated specifically for crankcase applications, Wynn's Heavy Duty Concentrate for Engines can be used in other mechanical components, such as compressors, pumps, hydraulic systems or manual gearboxes, which are lubricated with engine oils.

Wynn's Heavy Duty Concentrate for Engines can be added directly to engines with each oil change, either when adding oil to the engine or mixed in bulk oil.

Wynn's Heavy Duty Concentrate for Engines has been formulated to provide outstanding performance in even the newest heavy duty diesel engines in the field. Changes in heavy duty diesel engine design in recent years place considerable stress on the engine lubricant in service. These engine design features include: higher horsepower output, better fuel economy, lower oil consumption, and better exhaust gas emission control. Additionally, heavier payloads, growth in turbocharging and extended overhaul periods, demand more from engine oil performance than ever before.

To improve power output and reduce hydrocarbon and carbon monoxide emissions, newer HD diesel engine pistons have tighter top lands. The reduced clearance between the top/crown land and cylinder liner helps reduce oil loss in new engines and maintains better compression, particularly when used with keystroke piston rings. In older diesel engines, with wider crown land to liner clearance, top ring sticking and lower piston deposits on the first and second lands, correlated with loss of oil consumption control.

Top ring sticking could be measured by the amount of deposit in the top groove, referred to as % top groove fill (TGF). By contrast, in the newer HD engine designs, the formation of carbon deposits on the tight-fitting top or crown land of the piston can lead to abrasion of the cylinder wall.

The result of the abrasion is a mirror glazing effect on the liner wall, called bore polishing. Bore polishing reduces the ability of cylinder liners to retain lubricant on the walls. Crown land carbon and bore polishing in newer HD engines has been shown by various researchers to correlate with the loss of oil consumption control.

Lower fuel consumption, despite higher horsepower output in new HD engines, can be largely attributed to the use of engine speed governors. Maintaining engine RPM below specific levels, keeps fuel consumption down. The effect of governed engine speed on fuel consumption in a Mack low-speed Maxidyne engine can be shown. Fuel consumption goes up with higher governed speed. However, lower engine speed also increases soot formation. The heavier soot-loading of the engine oil, stresses dispersancy properties. Soot acts as an abrasive when improperly dispersed in the oil, and accelerates oil oxidation and thickening.

Piston and ring design for lower oil consumption in a new engine, means less fresh oil top-ups are added to replenish spent engine oil additives. At the same time, more efficient and hotter-running engine designs for higher power output, coupled with heavier payloads and longer overhaul intervals, demand better oxidation and wear control from the engine lubricant in service.

Wynn's Heavy Duty Concentrate for Engines, is a powerful combination of dispersants, detergents, antioxidants and antiwear additives, that has been demonstrated to upgrade API CH-4 lubricants to meet or exceed the performance requirements demanded by modern HD engines.

Typical Characteristics

Appearance	Clear Liquid
Colour (Visual)	Dark Brown
Colour (ASTM D 1500)	8.0
Density @ 15^{o}C	0.893 (ASTM D 4052)
Viscosity @ 40^{o}C (cSt)	52.8 (ASTM D 445)
Viscosity @ 100^{o}C (cSt)	7.78 (ASTM D 445)
Viscosity Index	112 (ASTM D 2270)
Flash Point (^{o}C) COC	210 (ASTM D 92)
Boiling Point (°C)	>288

Performance Testing

There exists a need for engine oil performance beyond the API CH-4 Standard. API CH-4 represents a significant upgrade over API CG-4 but it does not address all of today's market needs.

Also API CH-4 does not address extended service interval capacity. Wynn's Heavy Duty Concentrate for Engines, with its new diesel lubricant technology, has been proven in extended service in a wide variety of engines and applications – laboratory and field service with North American and European engine designs.

Evolving engine designs present performance challenges not addressed by API Ch-4, with bore polish being a prime example.

Performance Durability – OEM Approved

Performance Specification	Status	Drain Interval
Mercedes Benz 228.3	Approved	45,000km
Volvo VDS-2	Approved	Under consideration by Volvo
Mack EO-M	Approved	Up to 64,000km
Cummins CES 20071	Approved	Up to 80,000km
Cummins CES 20072	Approved	Up to 60,000km
DDC Series 2000/4000	Approved	500 Hours

Note that Wynn's Heavy Duty Concentrate for Engines is "blanket" approved against all of the above specifications.

Bore Polish

Bore polish is not evaluated in API CH-4 tests and is a different wear mechanism than the liner wear measured by the Mack T-9 test.

Liner wear evaluated in the Mack T-9 test is primarily the result of wear between the top ring and liner at the top-ring reversal point (highest point the piston travels in the engine).

In general, bore polish occurs when deposits form on the top land and polish the cylinder wall, much like sandpaper. This removal of the cylinder surface finish can result in excessive oil consumption.

The potential for bore polish increases as the top land to bore clearance, and crevice volume, are reduced. Both of these have been reduced in North American engines to improve emissions.

Top Land to Bore Clearance in Diesel Engines

Year	North American Engine Design	European Engine Design
1988	1.20mm	-
1993	0.60mm	0.25mm
1996	-	0.20mm
1998	0.30mm	-

To meet even stricter emission targets, the top land to bore clearance has decreased dramatically, increasing the potential for bore polish and oil consumption.

Bore Polish Protection

Bore polish can lead to excessive oil consumption and premature engine rebuild.

Although API CH-4 tests do not address bore polish protection, both the ACEA and Mercedes Benz specifications evaluate bore polish protection (OM 364A, OM364LA and OM602A tests).

The Volvo Drain Specifications (VDS) evaluate bore polish protection in extended drain field service.

The new technology of Wynn's Heavy Duty Concentrate for Engines, offers proven bore polish protection.

Bore Polish in OM 364A Engine Test

Test	% Bore Polishing
ACEA E1-96 Limit (Maximum)	8.0
ACEA E3-96 Limit (Maximum)	2.5
Wynn's HDCE Performance	0.4

Performance Validation

API CH-4 tests can be valuable predictors of field performance but they cannot anticipate all of the conditions experienced in the field.

The outstanding performance of the new technology of Wynn's Heavy Duty Concentrate for Engines has been validated not only in API CH-4 testing, but also in extensive laboratory testing beyond that defined by API CH-4 (including European engine testing), in extensive field testing in both North American and European engines, and testing in engines from all major OEMs.

Field Performance

The performance of Wynn's Heavy Duty Concentrate for Engines was demonstrated under extremely severe test conditions:-

(a) 1997 Caterpillar 3406E Engines with articulated (iron/aluminum) pistons.

(b) 61,240kg gross vehicle weight (GVW) which is 70% higher load than USA maximum of 36,290kg.

(c) 56,000km drain intervals with SAE 15W-40 engine oil (Kinematic Viscosity @100°C 15.0 cst) of TBN 9.6 and TAN 2.0.

(d) Test conducted outside of USA (High Load Field Test) with 75% Load Factor (475 HP @ 1,800rpm).

Total Acid Number (TAN) and Total Base Number (TBN) Levels

Kilometers on Oil	Drain Oil Analysis (Fleet Average)	
	TAN	TBN
12,430	2.2	8.4
25,100	2.4	7.9
37,290	2.5	7.6
52,920	2.7	7.0

Wear Metal Levels

Kilometers on Oil	Drain Oil Analysis (Fleet Average)		
	Iron	Copper	Lead
12,430	5	2	3
25,100	11	3	3
37,290	15	5	5
52,920	20	7	6

Kinematic Viscosity @ 100°C (cst)

Kilometers on Oil	Drain Oil Analysis (Fleet Average)
	Viscosity
12,430	13.8
25,100	13.7
37,290	13.9
52,920	14.2

Wynn's Heavy Duty Concentrate for Engines provided excellent TBN retention and wear protection, and resulted in negligible oil thickening.

OEM Needs

Diesel engine manufacturers face a very challenging environment. Global relationships have increased the need for lubricants to meet a wider variety of performance requirements – a global oil.

Engine life cycles have been reduced. Engines can be replaced by new designs in 6-12 months. Lubricants that can meet the performance needs of these new engines are critical.

The new technology of Wynn's Heavy Duty Concentrate for Engines is formulated to go beyond API CH-4 and address the current and future needs of OEM's and end-users.