LUBE-TECH
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WORLDWIDE PERFORMANCE SPECIFICATION FOR DIESEL ENGINE OIL (WWHD-1)

BACKGROUND

The concept of the world as a 'global village' has increased rapidly with the development of the internet and e-commerce. At the same time, large-scale manufacturers of e.g. cars and commercial vehicles have maintained a competitive edge by 'globalising' their operations, as they seek to reduce costs by benefiting from economies of scale-up and also by attracting grants from countries anxious to attract business investment. Computer-designed vehicles are becoming less distinguishable by manufacturer, since there is generally only one optimum package for a given set of requirement criteria. As a result, national differences between vehicles have narrowed, although the US market has been historically somewhat apart from most other areas, being in the main segregated between gasoline passenger cars and heavy duty commercial diesels, with virtually no light-duty diesels as are common in Europe and elsewhere. However, this situation is changing rapidly. Vehicle usage patterns also differ, being influenced by fuel availability considerations, particularly in terms of price and quality, localised legislation including emissions control, the general localised economic situation and population prosperity, and also by local geographical conditions.

The North American diesel engine lubricant market in particular is evolving to a global marketplace as the presence and influence of international companies grows. One example is Volvo, which manufactures engines in Sweden for use in Volvo Truck North America's commercial vehicles. They require that diesel oils be field tested in Volvo engines to gain Volvo VDS or VDS-2 extended drain acceptance. As such collaboration with European partners or parent companies is likely to increase, there is an increasing requirement for lubricants that meet both North American and European performance.

Through their collaboration with MTU, a subsidiary of Daimler-Benz, Detroit Diesel has introduced the Series 2000 and 4000 engines that require Detroit Diesel/MTU Type 1 or Type 2 lubricants. To gain Type 1 approval, a lubricant must meet the requirements of ACEA E2-96 and API CG-4. Type 2 approval requires ACEA E3-96 performance and allows end-users to extend drain intervals. Detroit Diesel and MTU have worked together for a number of years to develop and market diesel engine technology resulting in the development of the Series 2000 and 4000 engines for off-highway application.

As a wholly owned subsidiary of Renault, Mack Trucks is another example of an engine manufacturer that sees a need to have global diesel lubricants.

A positive step towards the first truly globalised lubricant was taken last year. Last June in Paris, representatives from the Society of Automotive Engineers (SAE) and the Coordinating European Council (CEC) attended a presentation from representatives of three diesel engine OEMs, namely Mack Trucks, AB Volvo and Isuzu, in turn representing their national bodies, namely the US Engine Manufacturers Association, the European Automobile Manufacturers Association and the Japanese Automobile Manufacturers Association.

SCOPE

The following specification in its original form was jointly developed by the European Automobile Manufactures Association (ACEA), Engine Manufacturers Association (EMA), and Japan Automobile Manufacturers Association (JAMA) for engine oils to be used in high-speed, four stroke-cycle heavy duty diesel engines designed to meet 1998 and newer exhaust emission standards worldwide.

Although initially described as a 'minimum performance specification', it was later made clear that the use of the term 'minimum performance' was to highlight the requirement that test limits called for minimum performance requirements; the lubricant itself was certainly not a lowest common denominator, bottom-tier product.

Oils meeting this specification are also compatible with certain older engines. Application of these oils is subject to the recommendation of individual engine manufacturers.

Engine oils meeting the minimum performance requirements of WWHD-1 are intended to provide a consistent oil performance worldwide and therefore may be recommended by engine manufacturers to maintain engine durability wherever their engine is being used. This specification identifies engine oil for use under adverse applications that necessitate wear control, high-temperature stability and soot handling properties. In addition, WWHD-1 is expected to provide engine oils with protection against non-ferrous corrosion, oxidative and insolubles thickening, aeration, and viscosity loss due to shear.

Recommendations of this performance specification in manufacturer's maintenance guides, owner's manuals, and related documents to describe the engine oils required for their products is voluntary. Oil marketers may voluntarily choose whether to market engine oils which meet this specification. ACEA, EMA and JAMA make no representation or guarantee as to whether oil marketers have collected sufficient data to support the performance of any of their specific oils.

TERMINOLOGY

HEAVY DUTY

Engine oils formulated to this specification are intended for use in diesel fueled engines used in vehicles with a Gross Vehicle Weight Rating of 8600 pounds (3900 Kgs) or higher.

PERFORMANCE LIMITS

The performance limits for the Worldwide Engine Oil Specification are summarized in tables 2a and 2b. While ACEA, EMA, and JAMA believe that in order to meet the performance limits of WWHD-1 engine oils should undergo a full test program, it is recognized that commercial practice often includes the use of interchangeability guidelines. Therefore the use of interchangeability and read across guidelines in effect for the marketed region is acceptable.

SIGNIFICANCE AND USE OF THE RECOMMENDED PROPERTIES

For the benefit of end-users and other interested parties, the following section summarizes terminology used in this specification, the critical properties of lubricating oils, and where appropriate, the reason for the selection of a particular quality level of that property.

Test Averaging Acceptance Criteria (TAAC)

Any data based approach for evaluation of the performance of an oil formulation where more than one test may be run. When more than one test is run on an oil formulation, the results are to be averaged. If three or more tests are conducted one test may be discarded from the average. All parameters must average to a passing result. TAAC only applies to those performance characteristics that are shown in Tables 2a and 2b with a single limit. Characteristics with more than one limit are based on the number of runs made and reflect the test's test precision without further averaging.

Piston Deposits and Bore Polish

Survey experience has shown buildup of ring belt deposits to cause improper ring operation, which can lead to high oil consumption and cylinder scuffing. This condition generally determines the life to overhaul for most diesel engines and may have an effect on emission levels. Two engine tests have been identified to measure this performance requirement. The Mercedes Benz OM 441LA test is used for evaluating piston deposit control in engines equipped with aluminum pistons, while the Caterpillar 1R test is used for ferrous pistons.

Wear, Ring/Liner

Piston ring and cylinder liner wear are directly related to engine service life. Under conditions of retarded fuel injection timing, used to meet reduced exhaust emission limits, fuel soot induced wear is likely. The capability of an engine oil to protect the piston rings and liner under these conditions is evaluated with the Mack T-9 test.

Wear, Valve train

Increased valve train loading, coupled with higher engine oil soot loading, as a result of engine design intended to meet reduced exhaust emission standards, has created a concern regarding excessive valve train wear. Wear of these components may change engine timing, impacting performance and exhaust emissions. Wear also shortens engine life. Valve train wear mechanisms may be either rolling or sliding depending on design. The Roller Follower Wear Test (RFWT ASTM D5966) is used to measure engine oil performance for its effect on axle shaft wear, indicating roller wear conditions. Sliding follower valve train wear mechanisms wear protection is measured in two tests. The Mitsubishi 4D34T4 measures engine oil performance effects on cam lobe wear and the Cummins M11 evaluates oil performance impact on rocker pad wear.

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