



The First in Synthetics®

Triple Length API Sequence IIIF Testing



Sequence IIIF

General Summary

PRODUCT

AMSOIL 10W-30 Motor Oil (product code ATM)

REVIEW AREAS

Viscosity Stability (thickening)
Varnish and Sludge Control (deposits)
Wear Control
Oil Consumption

REVIEW METHODOLOGY

API Sequence IIIF
ASTM Test Method D-5533

SCOPE

The life expectancy of motor oil is based largely on the oil's ability to resist deterioration in the presence of elevated temperatures. Exposure to elevated operating temperatures promotes oxidation, which leads to an increase in the viscosity of the oil. It also accelerates the generation of varnish and sludge (deposit formation), resulting in increased oil consumption and a compromise in wear control. Increasing the thermo-stability of an oil will directly result in extended oil service life, without compromising equipment performance or longevity.

DESCRIPTION OF TEST METHOD

To determine oil performance in the review areas, a Sequence IIIF evaluation was run. The Sequence IIIF test was specifically developed for such a review and is readily accepted within the industry today. It is part of the review process required by API for the current gasoline service classification SL. Typically, the test duration is 80 hours. To provide the information required for this review the duration was extended to 240 hours, three times the standard test duration.

The method utilizes a dynamometer and a 1996 model Buick 3800 Series II, water-cooled, 4-cycle, V-6 engine as a test apparatus. Prior to the start of the test the engine is disassembled, inspected and baseline wear measurements are recorded. Test oil is added to the engine and both are exposed to a limited run (leveling process). The engine is then operated under specific parameters, promoting elevated thermo-stress of the oil. Oil samples are drawn from the engine at 10-hour intervals and used to review changes in oil viscosity during the test. The amount of oil being consumed by the engine is also monitored and documented. Wear and deposit control are

determined at the end of the test via engine teardown and inspection.

RESULTS (Viscosity Stability)

The kinematic viscosity of the oil was determined at 10-hour intervals during the test and compared to the viscosity of the oil at the end of the initial leveling run. Changes are reported in percent increase (or decrease) from the initial leveling run viscosity. According to the API requirements for service classification SL, the maximum allowable increase in viscosity is 275% in 80 hours. The result of the AMSOIL product was a 92.42% increase in viscosity after 240 hours.

For the consumer, this equates to an oil that maintains its overall lubricant film strength throughout its service life. Lubricants that remain within their indicated viscosity grade provide an enhanced level of component protection from premature wear versus those that quickly fall out of grade. In addition, they offer a resistance to oxidation-related oil thickening which leads to improved fuel economy. The test results indicate that AMSOIL 10W-30 is capable of providing the necessary protection while maintaining its fluid viscosity even when exposed to these severe conditions for triple the test duration.

RESULTS (Varnish and Sludge Control)

Varnish and sludge control is determined by reviewing the extent to which deposits exist within the engine at the conclusion of the test. Areas of inspection are the skirts of the pistons for varnish and the piston grooves, ring lands and under-crowns regions for deposits. The degree of deposit formation is evaluated according to a cleanliness code numbering 1 through 10, with 10 being considered clean. The "weighted piston deposits" result, which is an

average of cleanliness in all areas mentioned above, was 4.51 for the AMSOIL product. "Average piston skirt varnish" results were 9.5. For API service classification SL, the minimum "weighted piston deposit" is 4.0 and 9.0 for "average piston skirt varnish."

Supplemental rating results (after 240 hours) in the area of deposit control were as follows. Note, in some cases specific performance in these areas may not be required for API service classification SL:

| | | |
|------------------------------------------|------------------|-------------------|
| Rocker arm cover deposits (left) | 9.55 | 10 = Clean |
| Rocker arm cover deposits (right) | 9.55 | 10 = Clean |
| Oil pan | 9.4 | 10 = Clean |
| Head, valve deck (left) | 9.45 | 10 = Clean |
| Head, valve deck (right) | Not rated | |

| | |
|-------------------------------------------|----------|
| Oil pump pick-up screen (sludge %) | 0 |
| Oil pump pick-up screen (debris %) | 0 |

Test results indicate that AMSOIL Synthetic 10W-30 Motor Oil maintains extreme cleanliness and is highly resistant to sludge and varnish buildup at elevated temperatures and extended durations. This is important because such contaminants can often times lead to deposit formations, resulting in increased oil consumption, accelerated wear and other performance issues.

RESULTS (Wear Control)

Wear control is determined by measuring camshaft lobes and their corresponding lifter before and after

240 Hours

Sequence IIIF

Head and Cover Deposits

Product: AMSOIL 10W-30 Code ATM
Test Number: CB103-09-0229

Oil Code: EYR-000925-A-01
Date Completed: 07-07-2002



Sequence IIIF

Pan and Pick-Up Screen Deposits

Product: AMSOIL 10W-30 Code ATM
Test Number: CB103-09-0229

Oil Code: EYR-000925-A-01
Date Completed: 07-07-2002



240 Hours

Sequence IIIF Skirt and Ring Land Deposits

Product: AMSOIL 10W-30 Code ATM
Test Number: CB103-09-0229

Oil Code: EYR-000925-A-01
Date Completed: 07-07-2002



the test. In the standard 80-hour test, maximum average cam and lifter wear can be no greater than 20.0 mm. For the AMSOIL product, average cam and lifter wear was 11.8 mm. This is 41% below the maximum allowable level at 80 hours, yet the AMSOIL product was subjected to 240 hours. This could be viewed as an 80% reduction in wear when compared to the maximum allowable for API service classification SL and the duration for which the AMSOIL product was tested.

Reducing friction and wear between components is of extreme importance in terms of increasing equipment life. Lubricants must be formulated to provide a protective barrier around components in an effort to reduce the amount of contact that may occur. This type of contact and fluid contamination are the two leading causes of premature wear and other types of component distress. Superior friction control can also lead to improved fuel economy. Regardless, benefits in other areas are insignificant if there is a compromise in wear protection.

RESULTS (Oil Consumption)

The amount of oil consumed is recorded throughout the test and must not exceed 5.2 liters in 80 hours. Consumption of the AMSOIL product was 4.55 liters in 240 hours. This is a 12.5% reduction from the 80-

hour allowable level and could be viewed as in excess of a 64% reduction considering the extended test hours the AMSOIL product was exposed to.

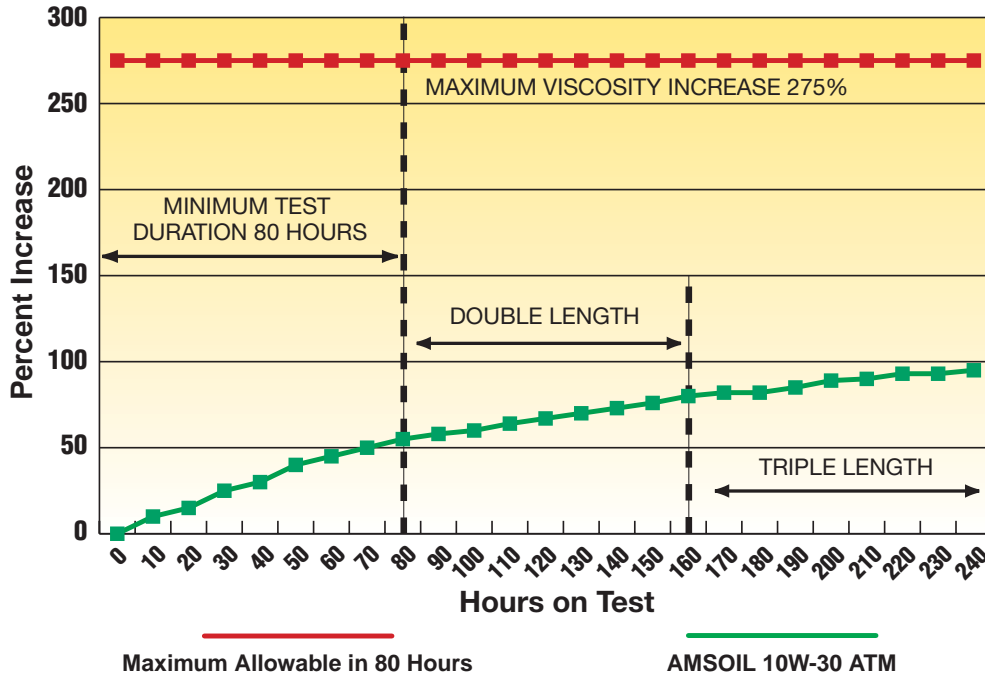
Replenishing oil lost through oil consumption is inconvenient and costly. The use of AMSOIL Synthetic 10W-30 Motor Oil, however, can significantly reduce oil consumption and operating costs. An additional benefit of low oil consumption is the reduction of harmful emissions in the atmosphere.

SUMMARY

In all cases, the test results were superior to those required for the standard test duration of 80 hours. Results involving low-temperature viscosity, for example, were such that they still meet the CCS and Mini-Rotary viscometer requirements for a new 10W motor oil according to SAE J300 APR97. This, in face of the fact the AMSOIL product was subjected to a duration some three-times longer. Of equal importance is that these results were obtained without compromise.

The magnitude of the result suggests far-reaching implications. Indeed, unsurpassed performance can now be afforded in even the most severe applications. Also, it justifies a need for a change in the way oil drain intervals are viewed. The results suggest significant extensions in oil drain intervals are obtainable and support the long-life claims made by AMSOIL.

Sequence IIIF Viscosity Increase



The results of the Sequence IIIF test clearly demonstrate the long-drain capability of AMSOIL 10W-30 Motor Oil. Even after being subjected to a triple-length sequence IIIF test, AMSOIL 10W-30 performed three times better than the standard test limits.

Sequence IIIF

Result Comparison With API Standards

| Parameter (limits) | API Service Classification SL | AMSOIL 10W-30 Product Code ATM |
|----------------------------------------------------------|-------------------------------|-------------------------------------------------------|
| Test Duration (hours) | 80 Hours | 240.00 |
| Kinematic Viscosity Increase (%) @ 40 °C (maximum) | 275.00 | 90.42 |
| Low Temperature Viscosity ASTM Test Method D-4684 & 5293 | Report | 7,342 cP @ -25 °C D-4684 3,212 cP @ -20 °C* D-5293 |
| Average Piston Skirt Varnish (minimum) 10 = Clean | 9.00 | 9.50 |
| Weighted Piston Deposits (minimum) 10 = Clean | 4.00 | 4.51 |
| Hot Stuck Piston Rings | None | None |
| Average Cam & Lifter Wear (um) (maximum) | 20.00 | 11.80 |
| Oil Consumption (L) (maximum) | 5.20 | 4.55 |

*Meets SAE J300 APR97 requirements for **new** 10W oils.

AMSOIL INC. has been the leader in synthetic motor oil formulation since its introduction of the world's first API rated synthetic motor oil in 1972. By specializing exclusively in synthetic lubricant technology, AMSOIL is able to optimize the most advanced chemistries available. The "Genuine Synthetic PAO Formulated" designation displayed on AMSOIL containers indicates that the oils are formulated with Polyalphaolefin (PAO) synthetic base stocks. This chemistry is the industry's premier base stock technology. Unlike conventional mineral-based chemistries, AMSOIL PAO base stocks contain fully



saturated, hydrogenated molecules and are free of wax and other impurities. Combined with an exact balance of premium additives, it delivers superior hot and cold temperature performance, resists oxidation and acid formation, and provides long-term wear protection.

AMSOIL "Genuine Synthetic PAO Formulated" oils have shattered the parameters of the most rigorous industry testing and set the standard for all other motor oils.

AMSOIL products and Dealership information are available from your local AMSOIL Dealer.



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ZO# 1220579
Brian Dobben - BSMET