

**The Relationship Between  
High-Temperature  
Oil Rheology  
and Engine  
Operation**

*A Status Report*



# THE RELATIONSHIP BETWEEN HIGH-TEMPERATURE OIL RHEOLOGY AND ENGINE OPERATION— A STATUS REPORT

Prepared by

ASTM Task Force D02.07.0B TF/EC on the Correlation of High-Temperature Oil Rheology with Engine Performance. ASTM Subcommittee D02.07.0B on High-Temperature Rheology of Non-Newtonian Fluids, Committee D-2 on Petroleum Products and Lubricants.

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## FOREWORD

**PURPOSE.** The ASTM High-Temperature Rheology/Engine Correlation Task Force (ASTM D02.07.0B TF/EC) has written this status report in partial response to a Society of Automotive Engineers (SAE) request to “develop a test method which incorporates high-temperature, high-shear rate viscometrics or other rheological characteristics to predict the performance of both single and multigrade (i.e., both Newtonian and VI-improved) engine oils in engine bearings and/or the ring and cylinder area (1). “Although this report does not deal with the development of particular viscosity measurement techniques, it does have two specific objectives which relate to this SAE request: (1) to summarize, and interpret, as necessary, all pertinent published studies relating high-temperature oil rheology to selected measures of engine performance and durability, and (2) to suggest areas for possible future research needed to resolve any uncertainties which remain regarding the effects of oil rheological properties on these same engine operating factors.

**SCOPE.** This review summarizes those available data which describe the effects of oil rheological properties on (1) the operating parameters (oil film thickness and load capacity of journal bearings), (2) the wear of engine components, and (3) the frictional characteristics and fuel economy of engines. These three subjects were selected for review because each is related to the specific areas of interest indicated in the SAE request. Furthermore, only high-temperature (that characteristic of warmed-up engine operation) engine performance is considered. Those engine performance parameters (cranking, pumping) which are associated with low-temperature operation are not within the scope of this review.

## Related ASTM Publications

The Relationship Between Engine Oil Viscosity and Engine Performance (Part V and VI),  
STP 621-S4 (1980), 04-621040-12

The Relationship Between Engine Oil Viscosity and Engine Performance (Part IV), STP  
621-S3 (1978), 04-621030-12

The Relationship Between Engine Oil Viscosity and Engine Performance (Part III), STP  
621-S2 (1977), 04-621020-12

The Relationship Between Engine Oil Viscosity and Engine Performance (Part II), STP  
621-S1 (1977), 04-621010-12

The Relationship Between Engine Oil Viscosity and Engine Performance (Part I), STP 621  
(1977), 04-621000-12

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