



Comparative Data

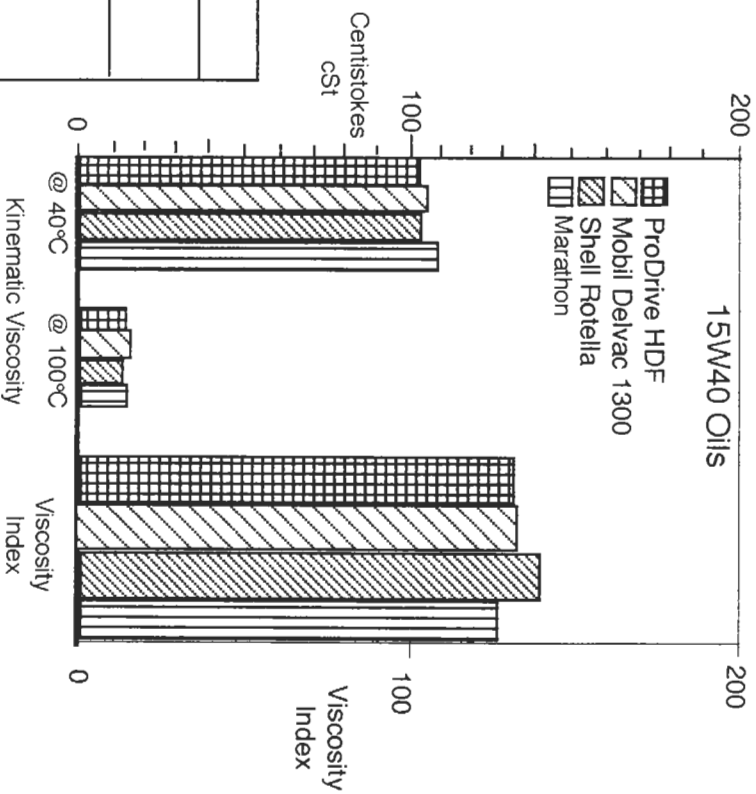
KINEMATIC VISCOSITY (ASTM D-445)

The Society of Automotive Engineers (SAE), American Society for Testing and Materials (ASTM), and International Standards Organization (ISO) have adopted a Viscosity Classification System for grades of lubricating oils.

This test determines the kinematic viscosity of lubricating oils to show how they fit into the classification system for viscosity grades. Also used to derive the Viscosity Index (V.I.).

A low viscosity index signifies a relatively large change in viscosity with temperature while a high V.I. indicates a relatively small change. A high V.I. is desirable.

Kinematic Viscosity and Viscosity Index for 15W40 Oils				
Measurements	Alisyn ProDrive HDF	Mobil Delvac	Shell	Marathon
KV @ 40°C	100.23	106.2	100.7	109.5
KV @ 100°C	13.60	14.31	13.97	14.25
Viscosity Index	136	137	141	132





Comparative Data

Aerospace Lubricants, Inc.

SHEAR STABILITY (ASTM D-3945B)

Measurement of oil viscosity under dynamic conditions of low and high shear is fundamental in judging lubricant performance.

Many oils contain VI improvers that can cause the oil to thin and lose some lubricating capabilities under the dynamic shear conditions encountered in engine bearings.

Thus, an oil that may qualify as a SAE 40W oil in all respects may have a tendency to shear causing it to behave like a 10W oil in the critical high shear regions of engine bearings.

ABBREVIATION KEY
 LSPVL = Low Shear Permanent Viscosity Loss.
 HSPVL = High Shear Permanent Viscosity Loss.
 HSTVL = High Shear Temporary Viscosity Loss.
 DGTVL = Degraded Temporary Viscosity Loss.
 OVL = Overall Viscosity Loss.

Shear Stability Measurement	SYNTHETIC OILS				PETROLEUM OILS		
	Aisyn ProDrive HDF (15W40)	Mobil Delvac 1 (5W40)	Mobil 1 (5W30)	Mobil 1300 (15W40)	Shell Rotella (15W40)	Marathon (15W40)	
LSPVL @ 100C, %	1.5	1.4	7.8	11.0	4.7	11.4	
LSPVL @ 150C, %	1.4	3.0	7.5	12.1	2.6	9.7	
HSPVL @ 150C, %	1.4	0.9	4.2	2.6	1.6	4.2	
HSTVL @ 150C, %	2.6	24.6	7.5	16.0	7.5	11.9	
DGTVL @ 150C, %	2.6	22.5	4.2	6.4	6.6	6.4	
OVL @ 150C, %	4.0	25.5	11.7	18.5	9.2	16.2	



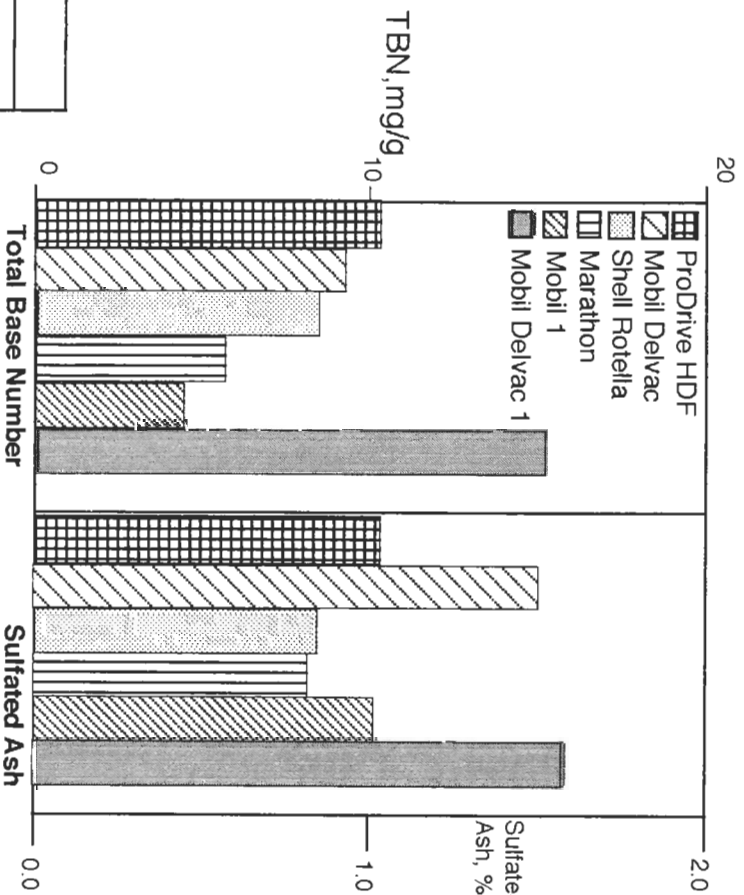
Comparative Data

TOTAL BASE NUMBER (TBN) (ASTM D-2896) AND SULFATED ASH (D-874)

The TBN of an oil is a measurement of the oil's resistance to acid forming conditions.

A high TBN is desirable in crankcase oil to combat corrosive engine wear from acids produced by the combustion process, particularly in diesel engines. However, high sulfated ash generally goes along with high TBN. Some engine manufacturers are concerned with sulfated ash above 1% because of reported high wear. Oil formulators generally try to achieve a balance between the two properties.

Measurement	ALISYN ProDrive HDF 15W40	Mobil Delvac 1300 SUPER 15W40	Shell Rotella 15W40	Marathon 15W40	Mobil 1 5W30	Mobil Delvac 1 5W40
TBN mg/g	11.6	11.4	9.1	7.15	6.4	15.7
ASH (D874), %	1.0	1.5	0.9	0.8	1.0	1.6





Comparative Data

LOW TEMPERATURE PROPERTIES

Lubricating oils must permit the engine to start easily and oil pressure to increase rapidly at low temperatures. Oils must pump easily and reach critical surfaces quickly during start up at any temperature.

These tests determine the apparent viscosity, pumping characteristics, and wax forming or gelling tendencies of lubricating oils at low temperatures and varying shear rates. Results are measured in centipoise (cP), a unit of absolute viscosity.

The Cold Cranking Simulation (CCS) determines the suitability of an oil for low temperature engine operation. The SAE CCS standard for a 15W/40 oil is 3500 cP max. viscosity at -15°C.

The Scanning Brookfield Technique (SBT) (D5133) is used to determine the critical pumpability temperature defined as the temperature at which the viscosity reaches 40,000 cP. This test indicates the sensitivity of the engine oil to air-binding or flow-limited pumpability problems. Stable pour point as defined as the lowest temperature at which the oil will pour.

The minirotary viscometer (MRV) (D3829) test is used to determine the engine oil viscosity at some SAE defined test temperature. The MRV TP-1 technique (D4684) is a more recent modification of D3829. The lower the viscosity at test temperatures, the better the pumpability at low temperatures.

Test Method	Alisyn ProDrive HDF 15W/40	Shell Rotella 15W/40	Mobil Delvac 1300 Super 15W/40	Marathon 15W/40
CCS, cP @ -15 °C	3290	3010	2990	3210
SBT, C @ 40,000cP	-34.6	-23.9	-28.7	-27.9
Stable Pour Point, °C	<-41	-33	-36	-39
MRV (D3829), cP @ -20C	7400	11,000	10,500	12,300
MRV (D4684), cP @ -20C	5500	14,000	11,200	13,000

SUBSCRIPTION NO.

Brand Name: ALISYN PRO 21 BATCH PD3005

SAE Grade: 15W40

PHYSICAL IESIS

- Oil Volatility (D 2887) -
 % Evap. Temp. & Evap. Temp.
 1 308 C 20 476 C
 5 383 35 488
 10 447 50 508
 % Volatized @ 371 C: 4.2

- Viscometric, Low Shear -
 Test Value
 Kinematic 40 C: 100.23 cst
 (D 445) 100 C: 13.60 cst
 (Viscosity Index: 136)
 5 passes 100 C: 13.40 cst*
 20 passes 100 C: 13.39 cst*
 Dynamic 150 C: 4.21 cP
 20 passes 150 C: 4.15 cP*

- Viscometric, High Shear -
 [TBS (D 4683) @ 1e6 1/sec]
 Dynamic: 150 C: 4.10 cP
 20 passes: 150 C: 4.04 cP*

- *Shear Stability (D3945B) -
 LS-PVL (kin.@100 C): 1.5 %
 (dyn.@150 C): 1.4 %
 HS-PVL (dyn.@150 C): 1.4 %
 HS-TVL (dyn.@150 C): 2.6 %
 DG-TVL (dyn.@150 C): 2.6 %
 OVL (dyn.@150 C): 4.0 %

- Low Temperature Properties -
 CCS (D2602) -15 C: 3.290 cP
 MRV (D3829) -20 C: 7.400 cP
 MRV (D4684) -20 C: 5.500 cP
 SBT (D5133) @ 40,000 cP: -34.6 C
 SPP (FTM 203 C) : <-41 C
 Max. Gel Index @ -8 C: 4.5

CHEMICAL IESIS

Test Value
 Sulfated Ash (D 874): 1.01 %
 Nitrogen (D 3228) : 0.20 %
 Sulfur (D 129) : 0.39 %
 TBN (D 2896) : 11.55 mg/g
 TFOUT (D 4742**) : 501 min
 AFOUT : 376 min
 (** calculated from AFOUT value)

ELEMENTAL ANALYSIS BY ICP

Element	PPM	Element	PPM
Aluminum	0	Magnesium	0
Antimony	3750	Molybdenum	0
Barium	0	Nickel	0
Boron	0	Phosphorus	0
Calcium	2430	Silicon	0
Chromium	0	Silver	0
Copper	0	Sodium	0
Iron	0	Tin	0
Lead	17	Zinc	365

