



Test Monitoring Center

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2001

ASTM REFERENCE OILS

This information was compiled using data from various sources. Part I contains oil code(s), viscosity grade, performance classification(s), year introduced, and average test performance for each reference oil by test area. Part II presents reference oil field data, where available, by test area. Part III contains the *Policies for the Use and Analysis of ASTM Reference Oils*. Finally, Part IV is a compilation of reference oil analytical data as permitted in the policy statement.

The ASTM Test Monitoring Center wishes to acknowledge those companies that supply reference oils for the ASTM calibration system.

ASTM REFERENCE OILS

PART I

Performance Classification

Oil Code Cross-Reference

Test Performance

SEQUENCE IIIF

Oil Code	Viscosity Grade	Performance Classification	Year ^a Introduced	Engine Test Data		
				Viscosity Increase (Percent)	Average Piston Varnish (CRC Merit)	Weighted Piston Deposits (CRC Merit)
TMC	CRC					
1006	5W-30	SJ	1997	4058	9.14	3.29
1008	5W-30	SJ	1999	124	9.74	4.52
433	5W-30	SL	2000	39	9.41	4.96

SEQUENCE IVA

Oil Code	Viscosity Grade	Performance Classification	Year ^a Introduced	Engine Test Data
				Average Camshaft Wear (Microns)
TMC	CRC			
1006	5W-30	SJ	1997	121.76
1007	5W-30	na ^c	1999	92.12

SEQUENCE VG

Oil Code	Viscosity Grade	Performance Classification	Year ^a Introduced	Engine Test Data					
				Average Engine Sludge (CRC Merit)	Rocker Cover Sludge (CRC Merit)	Average Engine Varnish (CRC Merit)	Average Piston Varnish (CRC Merit)	Oil Screen Clogging (Percent)	
TMC	CRC								
925	5W-30	SF	1987	6.23	7.38	8.57	7.40	4	
1006	5W-30	SJ	1997	8.43	9.35	9.27	8.49	1	
1007	5W-30	na ^c	1999	8.93	8.99	9.24	8.57	1	

SEQUENCE VIA

Oil Code		Viscosity Grade	Performance Classification	Year ^a Introduced	Engine Test Data	
TMC	CRC				FEI (Percent)	FEI (Percent)
529		5W-30	na ^c	1995		1.49
531		10W-30	SH/CD/Energy Conserving II	1995		0.45
534		5W-30	SH/GF-1	1995		0.79
535		5W-20	na ^c	1995		1.57
536		5W-30	SG	1995		1.13
1002		10W-30	SG	1995		0.39
1006		5W-30	SJ	1997		1.27

SEQUENCE VIB

Oil Code		Viscosity Grade	Performance Classification	Year ^a Introduced	Engine Test Data	
TMC	CRC				FEI (Percent)	FEI2 (Percent)
1006		5W-30	SJ	1997	1.40	0.50
1008		5W-30	SJ	1999	1.88	1.27

SEQUENCE VIII

Oil Code		Viscosity Grade	Performance Classification	Year ^a Introduced	Engine Test Data	
TMC	CRC				Total Bearing Weight Loss (milligrams)	10-Hour Stripped Viscosity (centistokes)
704		10W-30	SF	1990	8.3	10.29
1006		5W-30	SJ	1997	15.6	8.98

1M-PC

Oil Code		Viscosity Grade	Performance Classification	Year ^a Introduced	Engine Test Data	
TMC	CRC				Top Groove Fill (Percent)	Weighted Total Demerits (CRC Demerit)
873		40	CD	1993	41.0	232.5

1K

Oil Code		Viscosity Grade	Performance Classification	Year ^a Introduced	Engine Test Data				
TMC	CRC				Top Groove Fill (Percent)	WDK (CRC Demerit)	Top Land Heavy Carbon (Percent)	Brake Specific Oil Consumption (g/kW-hr)	EOT Oil Consumption (g/kW-hr)
809,1001	217	15W-40	SE/CD	1990	17.5	216.4	0.8	0.268	1.711
810,1003	212	15W-40	CD	1990	55.3	261.3	5.9	0.375	0.407
811		15W-40	SF/CE	1990	27.3	327.7	1.4	0.267	1.208

1N

Oil Code		Viscosity Grade	Performance Classification	Year ^a Introduced	Engine Test Data			
TMC	CRC				Top Groove Fill (Percent)	WDN (CRC Demerit)	Top Land Heavy Carbon (Percent)	Oil Consumption (g/kW-hr)
809,1001	217	15W-40	SE/CD	1990	33.9	198.1	2.9	0.322
810,1003	212	15W-40	CD	1990	70.8	273.3	11.8	0.540
811		15W-40	SF/CE	1990	24.7	281.5	0.4	0.223
1004		15W-40	SH/CG-4/CF/CF-4/CD	1993	30.4	204.0	0.6	0.206

1P

Oil Code		Viscosity Grade	Performance Classification	Year ^a Introduced	Engine Test Data				
					Top Groove Carbon (CRC Demerit)	Top Land Carbon (CRC Demerit)	Average Oil Consumption (g/kW-hr)	WDP (CRC Demerit)	EOT Oil Consumption (g/kW-hr)
TMC	CRC	15W-40	SH/CG-4/CF/CF-4/CD	1993	29.5	28.1	6.2	319.6	7.8
1004		15W-40	na ^c	1997	28.7	30.9	6.5	285.3	5.0

1R

Oil Code		Viscosity Grade	Performance Classification	Year ^a Introduced	Engine Test Data				
					Top Groove Carbon (CRC Demerit)	Top Land Carbon (CRC Demerit)	Initial Oil Consumption (g/kW-hr)	WDP (CRC Demerit)	EOT Oil Consumption (g/kW-hr)
TMC	CRC	15W-40	na ^c	2001	34.11	22.82	8.3	341.2	7.9
820, PC-9A		15W-40	SH/CG-4/CF/CF-4/CD	1993	34.50	18.60	9.9	327.3	8.3

T-8/T-8E

Oil Code		Viscosity Grade	Performance Classification	Year ^a Introduced	Engine Test Data	
					Viscosity Increase @ 3.8% Soot (cSt)	Relative Viscosity @ 4.8% Soot (cSt)
TMC	CRC	15W-40	SH/CG-4/CF/CF-4/CD	1993	4.57	2.07
1004		15W-40	SH/CG-4/CF/CF-4/CD	1993	4.57	2.07

T-9

Oil Code		Viscosity Grade	Performance Classification	Year ^a Introduced	Engine Test Data	
TMC	CRC				Adjusted Liner Wear (Microns)	Top Ring Weight Loss (Milligrams)
1005		15W-40	na ^c	1997	24.6	93.7
						53

T-10

Oil Code		Viscosity Grade	Performance Classification	Year ^a Introduced	Engine Test Data		
TMC	CRC				Adjusted Liner Wear (Microns)	Top Ring Weight Loss (Milligrams)	Δ Pb @ EOT (ppm)
820, PC-9A		15W-40	na ^c	2001	32.5	134	8.2
							49.6

6V92TA

Oil Code		Viscosity Grade	Performance Classification	Year ^a Introduced	Engine Test Data		
TMC	CRC				Fire Ring Distress (Demerits)	2 nd & 3 rd Ring Avg. Distress (Demerits)	Liner Scuffing (%)
861,1001	217	15W-40	SE/CD	1990	0.297	0.224	58.2
862		30	CD-II/SF	1990	0.127	0.117	23.7

ROLLER FOLLOWER WEAR TEST

Oil Code		Viscosity Grade	Performance Classification	Year ^a Introduced	Engine Test Data Avg. Roller Follower Shaft Wear (Mils)
TMC	CRC				
1004		15W-40	SH/CG-4/CF/CF-4/CD	1993	0.33
1005		15W-40	na ^c	1997	0.20

M11

Oil Code		Viscosity Grade	Performance Classification	Year ^a Introduced	Engine Test Data	
TMC	CRC				Adjusted Crosshead Wear (Transformed Units)	Oil Filter Δ P (kPa)
1005		15W-40	na ^c	1997	4.53	122.3
						8.40

M11 EGR

Oil Code		Viscosity Grade	Performance Classification	Year ^a Introduced	Engine Test Data		
TMC	CRC				Adjusted Crosshead Wear (Milligrams)	Oil Filter Δ P (kPa)	Average Sludge (CRC Merit)
830_PC-9E		15W-40	na ^c	2001	17.3	137.3	8.50
							131.7

ENGINE OIL AERATION TEST

Viscosity Grade		Performance Class	Year ^a Introduced	Engine Test Data Average Engine Oil Aeration (Percent)
TMC	CRC			
1004		15W-40	SH/CG-4/CF/CF-4/CD	1993
1005		15W-40	na ^c	1997
				9.46
				7.80

L-33

Oil Code		Viscosity Grade	Year ^a Introduced	Gear Rig Test Data
TMC	CRC			
121		80W-90	1992	9.83
123		90	1995	8.24

L-37

Oil Code		Viscosity Grade	Year ^a Introduced	Gear Rig Test Data						
TMC	CRC			Pinion Ridging (CRC Merit)		Pinion Pitting/Spalling (CRC Merit)		Pinion Wear (CRC Merit)		
				Lubrited Gears	Non-Lubrited Gears	Lubrited Gears	Non-Lubrited Gears	Lubrited Gears	Non-Lubrited Gears	
127		80W-90	1993	-	6.89	-	7.98	-	9.18	5.80
128		80W-90	1993	6.63	7.83	7.21	7.96	9.90	9.77	6.40
129		90	1993	9.19	9.46	8.85	9.22	9.61	9.89	7.08
151		80W-90	1993	6.86	9.36	9.00	8.85	9.87	9.93	7.63

L-42

Oil Code		Viscosity Grade	Year ^a Introduced	Gear Rig Test Data		
TMC	CRC			Coast Side Pinion Scoring (Percent)		Gear Batch P8L327
				Gear Batch P8L737	Gear Batch P8L327	
114		90	1994	23.433	20.167	25.333

L-60-1

Oil Code		Viscosity Grade	Year ^a Introduced	Gear Rig Test Data				
				Viscosity Increase (Percent)	Pentane Insolubles (Percent)	Toluene Insolubles (Percent)	Average Carbon/Varnish (CRC Merit)	Average Sludge (CRC Merit)
TMC	CRC							
131		90	1991	75.9	2.56	0.92	1.05	9.48
133		85W-140	2000	93.7	2.80	1.40	6.55	9.38
143		80W-90	1989	31.5	1.27	0.91	9.00	9.50
148		80W-90	1993	37.0	0.39	0.26	8.31	9.53
151		80W-90	1993	37.3	2.12	1.30	8.59	9.42

HIGH TEMPERATURE CYCLIC DURABILITY TEST

Oil Code		Viscosity Grade	Year ^a Introduced	Gear Rig Test Data	
				Cycles to Unsynchronized Shifts (Number of Cycles)	
TMC	CRC				
150		80W-90	1993	28,932	
151		80W-90	1993	80,294	

FOOTNOTES

- a Indicates the year of introduction of the Reference Oil to the Test Monitoring System or by the Test Sponsor for years prior to 1976.
- b The performance classification relates only to the Rust parameter.
- c na = Information not available.

ASTM REFERENCE OILS

PART II

Field Data

**FIELD DATA
ASTM REFERENCE OILS**

TEST	SEQUENCE II			SEQUENCE IIIE		SEQ. III (400 SERIES) SEQ. VE (900 SERIES)	
	1A	7I	8C	72A 472	404	424 924	425 925
Type of Service	Short Trip			Field	Taxicab	Taxicab	
No. of Vehicles per Oil					100,000 mi.	60,000 - 100,000 mi.	
Vehicle Mileage							
Engine Model and Size					3.8L - V6 BUICK	3.8L - V6 CHEVY	
Oil Change Interval, Miles					5,000 mi	7,500 mi	
Filter Change Interval, Miles					5,000 mi	7,500 mi.	
Fuel						Unleaded	
Deposits & Wear							
Rust	9.7	7.7	5.2		--	4.8	5.6
Ring Land Deposits					5.9	7.4	6.9
Piston Skirt Varnish					9.4	9.2	8.5
Sludge							
Cam & Lifter Wear							
Avg. (10 - 4 IN.)				Unacceptable	32-111	58	76
Max. (10 - 4 IN.)					81-175	164	200
Viscosity Increase, %					20-170	--	--

**FIELD DATA
ASTM REFERENCE OILS**

TEST		SEQUENCE VE					
OIL		200		200		200	200
Type of Service		Taxicab		Taxicab		Taxicab	Taxicab
No. of Vehicles per Oil	2	2	2	2	2	3	3
Vehicle Mileage	60,000	104,000	70,000	105,000	50,000	60,000	60,000
Engine Model and Size		350 CID Chevy V-8		225 CID Six Cyl. Dodge		3.8L Chevy V-6	
Oil Change Interval, Miles	12,000		3,000		7,500		7,500
Filter Change Interval, Miles	12,000		3,000		7,500		7,500
Fuel	Leaded	Unleaded	Leaded	Unleaded	Unleaded		Unleaded
Deposits & Wear							
Sludge	5.8	5.6	8.4	9.3	9.4	9.7	9.7
Varnish	5.5	4.8	5.8	6.0	7.5	5.5	5.5
Piston Skirt Varnish	7.2	7.2	6.6	6.6	6.4	6.1	6.1
Cam & Lifter Wear Avg. (10 -3 IN.)	20.4	5.8	10.2	5.2	8.0	5.3	5.3

**FIELD DATA
ASTM REFERENCE OILS**

TESTS	SEQUENCE V (900 SERIES) L-38 (700 SERIES)									
	901 702	907 703	903	911	915	916	914	921	923	
Type of Service	Taxicab		Taxicab		Factory Full Oils		Taxicab	Taxicab		Delivery Vans
No. of Vehicles	5	5	3	3	20	Field Service	5	4	2	2
Vehicle Mileage	48,000		45,000		Up To 63,000		57,000	83,000	45,000	
Engine Model and Size	Ford L-6 4.1L (240 CID)		Chrysler L-6 3.7L (225 CID)		Ford Engines	Ford Engines	Chevrolet L-6 4.2L (250 CID)	Plymouth L-6 3.7L (225 CID)	Chrysler V-8 7.2 (440 CID)	Ford L-6 4.9L (300 CID)
Oil Change Interval, Miles	6,000		6,000		5,000 & 10,000		12,000	6,000	6,000	15,000
Filter Change Interval Miles	12,000		6,000		5,000 & 10,000		12,000	6,000	6,000	15,000
Fuel	Unleaded		Leaded		Unleaded	Unleaded	Unleaded	Leaded	Unleaded	
Deposits & Wear										
Sludge Varnish	9.7	9.1	8.5	6.1	7.9+	Good History In Field Service	8.7	8.5	9.6	9.6
Piston Shirt Varnish	7.8	6.4	4.9	3.6	4.5+		6.3	6.7	9.2	8.7
Average Wear	7.4	7.3	5.6	5.9	5.6+		6.3	6.2	8.8	7.7
Cam (10 -3 IN.)	1.2	2.1	2.0*	3.4*	Border-line Fail		2.8	1.8*	Low	Low
Lifter (10 -3 IN.)	1.4	2.5					0.2			

* Cylinder Bore Wear

ASTM 5 CAR TEST DATA

	MAKE	TYPICAL MODEL					ENGINE TYPE	DISPLACEMENT IN LITERS	
		502	513	515	516	517	518	519	521
Number of Car Tests	1. Ford 2. Ford 3. Chevrolet 4. Buick 5. Plymouth	1	3	2	5	3	3	2	2
Vehicle Mileage						>10,000			
Oil Change Interval Miles						2,000			
Filter Change Interval Miles						2,000			
Fuel						AMOCO 91			
5 Car Test Result Combined FE %		3.25	1.95	2.70	1.19	2.22	2.70	2.70	3.10
Sequence VI									
EFEI %		3.17	2.18	2.79	0.74	2.13	2.23	2.50	3.10

FIELD DATA

ASTM REFERENCE OILS

TEST	SG CATEGORY TESTS
OIL	1002*
TYPE OF SERVICE	TAXICAB
VEHICLE MILEAGE	60,000
ENGINE MODEL AND SIZE	4.3L CHEVY V-8
OIL CHANGE INTERVAL, MILES	7,500
DEPOSIT AND WEAR	
SLUDGE	8.33
VARNISH	4.43
AVG. RING WT. LOSS (grams)	0.698
AVG. CAM LOBE WEAR (in x 10,000)	4.3
AVG. LIFTER WEAR (in x 10,000)	4.8
AVG. MAIN BEARING WT. LOSS (grams)	0.162
AVG. CYLINDER BORE WEAR (in x 10,000)	19.2
AVG. MAIN BEARING JOURNAL WEAR (in x 10,000)	2.4
AVG. CRANKSHAFT ROD JOURNAL WEAR (in x 10,000)	3.2
AVG. ROD BEARING WT. LOSS (grams)	0.147

* 1002 DI package blended in an alternate Category I base stock. Viscosity grade is 5W-30.

FIELD DATA
ASTM REFERENCE OILS

TEST	SJ CATEGORY TESTS
OIL	1006
TYPE OF SERVICE	TAXICAB
NUMBER OF VEHICLES	4
VEHICLE MILEAGE	105,000
ENGINE MODEL AND SIZE	CHEVROLET 4.3L V-8
OIL CHANGE/FILTER CHANGE INTERVAL, MILES	12,000/9,000
FUEL	UNLEADED
DEPOSITS	
SLUDGE (AVERAGE)	9.38
VARNISH	5.92
PISTON SKIRT VARNISH	5.96

ASTM REFERENCE OILS

PART III

**Policies for the Use and Analysis
of ASTM Reference Oils**

POLICIES FOR THE USE AND ANALYSIS OF ASTM REFERENCE OILS

The primary use of ASTM reference oils is for calibration of test stands used to conduct tests monitored by the ASTM Test Monitoring Center (TMC) at laboratories participating in the ASTM Test Monitoring System. The System shall attempt to provide reference oils for other testing purposes provided that such use does not interfere with test stand calibration. The following policies are divided into four categories of reference oil use: Test Stand Calibration, New Test Development, Bench Performance Test Development and Correlation, and Fleet Testing and Other Bulk Use.

Test Stand Calibration

Each reference oil sample distributed by the TMC for test stand calibration bears a CMIR code and a test area designation. These samples are to be used only for test stand calibration. No alternative use of these oil samples is permitted without TMC approval. The TMC will decode reference oil samples for use in diagnosing problems on a normally calibrated stand or for use in evaluating new stands and new laboratories when an intention to enter the ASTM Test Monitoring System has been indicated. Samples will also be available for industry test programs for fuel batch and hardware approval. Redistribution of reference oil samples, including retains, is not permitted without TMC approval. These reference oil samples shall not be analyzed for physical or chemical properties beyond what is permitted in the ASTM test procedure for which a sample is designated. The TMC will publish, with the permission of the supplier, the following physical and chemical properties for each batch of crankcase reference oil:

Property	Method
Metals (Ca, Mg, Mo, Zn, P, Ba, Na, S, B)	ASTM D 5185
Kinematic Viscosity @ 40°C and 100°C	ASTM D 445
HTHS @ 150°C	ASTM D 4683
CCS	ASTM D 5293
MRV	ASTM D 4684
Scanning Brookfield	ASTM D 5133
Shear Stability Index	ASTM D 6278
Sulfated Ash	ASTM D 874
TBN	ASTM D 4739
Volatility	ASTM D 5480

The cost per gallon of reference oil used for test stand calibration is established by the ASTM Test Monitoring Board according to the *Regulations Governing the ASTM Test Monitoring System*.

New Test Development

Reference oil samples are available for use in the development of new tests that are intended to become ASTM standard methods. These uses include primary hardware screening by test developers as well as industry approved designed experiments for estimating levels of test discrimination and precision. A request for such reference oil samples shall be made to the TMC and shall include the specific oil(s) with estimated quantities needed and a description of the intended use of the oil(s). Policies for alternative use, redistribution, and analysis are the same as for test stand calibration samples. The cost per

gallon of reference oil used for new test development shall be the same as the cost estimated for test stand calibration.

Bench Performance Test Development and Correlation

Crankcase reference oil samples in one-gallon quantities are available for use in the development and correlation of bench performance tests. A written request for such reference oil samples shall be submitted to the TMC and shall include the specific oil(s) needed and a description of the intended use of the oil(s). Availability is limited to one gallon/reference oil/year/company. Analyses of physical or chemical properties of these samples are limited to those types and methods published by the TMC (see list in Test Stand Calibration section). The supplier(s) of the specific reference oil(s) must also have granted permission of these analyses to be performed. Users are urged to share any data obtained using these reference oil samples with the TMC and the appropriate ASTM surveillance panel(s). The cost per gallon of reference oil used for bench performance test development and correlation shall be ten (10) times the cost established for test stand calibration. Gear reference oils are only available for ASTM bench performance test development and correlation.

Fleet Testing and Other Bulk Use

Due to the uncertainty of the volumes of reference oils needed for fleet testing and other bulk uses, arrangements will be made for CRC to supply reference oils for these purposes. Requesters and suppliers will be referred to CRC as specific needs arise. Further, suppliers will be encouraged to blend additional reference oil for distribution by CRC when they are producing blends for the TMC. Every effort will be made to protect the identity of suppliers and to maintain the same limitations on analyses of physical or chemical properties that may be performed.

ASTM REFERENCE OILS

PART IV

Reference Oil Analytical Data

REFERENCE OIL ANALYTICAL DATA

Oil	Vis Grade	D5480	D6417	D5133	D5133	D4683	D3945*	D4684
		mass %	mass %	Deg C @30,000 cP	Deg C @40,000 cP	cP @150 Deg C	Vis. Loss %	cP / Deg C
433	5W-30	3.7	--	-33.7	-35.2	3.12	14.55	yield stress/-35
433-1	5W-30	--	5.4	-33.3	-34.9	3.12	12.34	yield stress/-35
529	5W-30	9.5	--	-30.1	-31.6	2.94	12.46	7,000/-30
529-1	5W-30	6.1	--	-35.0	-35.5	2.97	12.74	10,200/-30
534	5W-30	17.2	--	-34.1	-35.5	3.09	13.40	11,700/-30
535-1	5W-20	4.3	--	-31.0	-32.0	2.61	10.14	6,200/-30
535-2	5W-20	5.2	--	-32.4	-33.3	2.70	16.94	8,600/-30
536	5W-30	18.3	--	-34.8	-36.4	2.88	18.00	12,700/-30
536-1	5W-30	14.9	--	-33.6	-35.3	2.94	20.37	25,600/-30
600	20	na	--	na	na	na	na	na
600-1	20	na	--	na	na	na	na	na
602-1	30	4.0	--	-9.1	-9.5	3.77	-0.16	na
604-1	20	na	--	na	na	na	na	na
606	20	na	--	na	na	na	na	na
704-1	10W-30	13.8	--	-15.4	-17.4	3.20	9.66	yield stress/-25
811-1	15W-40	8.0	--	-28.7	-30.1	3.91	21.75	7,500/-20
811-2	15W-40	9.0	--	-27.4	-28.9	3.77	21.55	10,400/-20
820 (PC-9A)	15W-40	--	11.6	-25.7	-27.5	4.27	9.77	27500/-25
830 (PC-9E)	15W-40	--	7.9	-18.6	-19.3	4.27	9.16	yield stress/-25
862-1	30	2.5	--	-19.1	-20.3	3.72	-0.08	na
873-1	40	na	--	na	na	4.14	na	na
925-3	5W-30	16.1	--	-25.8	-27.1	2.66	29.20	37,900/-30
1001	15W-40	14.1	--	-26.8	-28.5	3.64	2.53	8,900/-20
1004-2	15W-40	8.6	--	-27.0	-28.5	4.10	17.71	9,600/-20
1004-3	15W-40	7.0	--	-26.6	-28.2	4.07	18.74	11,500/-20
1005	15W-40	9.6	--	-26.5	-28.0	4.31	20.64	9,000/-20
1005-1	15W-40	--	14.7	-26.9	-28.4	4.34	20.23	17700/-25
1006	5W-30	18.5	--	-34.5	-35.9	3.03	17.16	54,200/-35
1006-1	5W-30	--	20.5	-34.7	-36.3	3.00	10.67	49000/-35
1006-2	5W-30	--	20.2	-34.4	-35.9	3.04	15.6	52400/-35
1007	5W-30	6.0	--	-35.4	-37.0	3.13	11.19	9500/-30
1008	5W-30	8.1	--	-34.7	-35.8	3.02	17.94	6800/-30

Oil	Vis Grade	D5185								
		Ba ppm	B ppm	Ca ppm	Mg ppm	Mo ppm	P ppm	Na ppm	Zn ppm	S wt%
433	5W-30	1	67	2095	<1	112	976	<5	1030	0.237
433-1	5W-30	<1	62	2047	4	110	933	<5	1010	0.229
529	5W-30	0	269	2074	8	327	598	0	632	0.306
529-1	5W-30	0	309	2197	10	388	552	2	574	0.244
534	5W-30	0	112	155	916	0	1000	0	1079	0.499
535-1	5W-20	0	1011	2091	12	680	1007	0	1108	0.371
535-2	5W-20	1	1142	2291	12	707	1009	2	1088	0.355
536	5W-30	0	76	1212	265	0	885	230	962	0.359
536-1	5W-30	0	93	1432	328	1	1029	246	1100	0.344
600	20	0	0	3	3	0	2	0	0	0.099
600-1	20	0	0	0	0	0	1	<25	0	0.105
602-1	30	0	0	2350	4	0	1	5	2	0.615
604-1	20	0	0	0	0	0	0	0	1	0.093
606	20	<1	87	366	<1	<1	1	<5	<1	0.357
704-1	10W-30	0	0	2349	4	0	963	20	1103	0.308
811-1	15W-40	0	173	33	1151	0	1072	0	1137	0.677
811-2	15W-40	0	214	5	1444	0	1361	10	1419	0.601
820 (PC-9A)	15W-40	<1	410	3473	12	<1	1309	6	1437	0.405
830 (PC-9E)	15W-40	<1	146	3108	297	<1	1219	<5	1302	0.330
862-1	30	0	7	12	1284	0	1129	1	1234	0.698
873-1	40	10	0	3880	10	0	0	10	0	0.260
925-3	5W-30	<1	45	5	1426	<1	878	16	956	0.425
1001	15W-40	0	0	2070	7	0	1139	8	1244	0.418
1004-2	15W-40	0	141	2078	8	99	871	0	979	0.516
1004-3	15W-40	0	151	2275	7	110	998	3	1101	0.535
1005	15W-40	0	217	586	1256	0	1314	2	1306	0.512
1005-1	15W-40	<1	240	546	1278	<1	1273	5	1343	0.510
1006	5W-30	0	123	1115	474	0	960	159	1049	0.506
1006-1	5W-30	<1	135	1084	498	<1	972	180	1047	0.492
1006-2	5W-30	<1	137	1084	513	<1	992	181	1065	0.490
1007	5W-30	0	57	74	1552	1	992	<25	1053	0.275
1008	5W-30	0	23	1811	15	738	1000	14	1099	0.371

Oil	Vis Grade	Vis@40 Deg C	Vis@100 Deg C	CCS	Sul Ash	TBN
		cSt	cSt	cP / Deg C	wt%	mgKOH/g
433	5W-30	59.9	10.3	2388/-25	0.94	6.78
433-1	5W-30	59.9	10.3	5538/-30	1.02	6.67
529	5W-30	50.8	9.8	3148/-30	0.89	6.89
529-1	5W-30	51.5	9.8	3415/-30	0.80	7.04
534	5W-30	59.9	10.1	3052/-25	0.68	5.77
535-1	5W-20	42.8	8.4	2261/-25	1.17	7.74
535-2	5W-20	42.6	8.4	2280/-25	1.25	7.89
536	5W-30	61.3	10.3	2992/-25	0.83	6.24
536-1	5W-30	61.0	10.3	2477/-25	0.78	6.44
600	20	37.0	6.5	na	0.00	3.40
600-1	20	37.4	6.5	na	0.00	6.22
602-1	30	107.2	12.3	na	0.84	2.86
604-1	20	55.6	8.1	na	0.00	4.35
606	20	53.8	8.0	na	0.34	2.99
704-1	10W-30	71.7	10.9	3214/-20	0.96	7.61
811-1	15W-40	100.8	14.2	2840/-15	0.74	7.23
811-2	15W-40	100.9	13.7	2741/-15	0.94	7.26
820 (PC-9A)	15W-40	116.6	15.2	6013/-20	1.59	9.48
830 (PC-9E)	15W-40	113.9	15.3	6056/-20	na	10.99
862-1	30	107.2	12.1	na	0.78	5.04
873-1	40	194.8	14.9	na	1.41	13.90
925-3	5W-30	72.0	11.3	2569/-25	0.73	6.90
1001	15W-40	98.0	13.8	3250/-15	0.92	7.55
1004-2	15W-40	106.0	14.6	3283/-15	0.88	6.14
1004-3	15W-40	109.2	14.6	3314/-15	0.94	5.94
1005	15W-40	116.6	15.8	2966/-15	1.00	8.06
1005-1	15W-40	120.1	15.8	3128/-15	1.11	8.02
1006	5W-30	59.8	10.1	3081/-25	0.79	6.50
1006-1	5W-30	59.0	10.1	6424/-30	0.83	6.90
1006-2	5W-30	58.8	10.1	6328/-30	0.77	6.99
1007	5W-30	61.6	10.2	2894/-25	0.81	6.94
1008	5W-30	51.4	10.5	1980/-25	0.78	5.78