



IOM Engine Oil Test Matrix

Test	Description	Method
Base Number	Base Number (or Total Base Number) determines the ability of an oil to neutralize combustion or engine oil oxidation acids. Reported in mg/g.	ASTM D2896
CCS	Low temperature, high shear stress viscosity using the Cold Cranking Simulator Viscometer. Test predicts the comparative ability of an oil to give satisfactory low-temperature engine cranking speed. Reported in cP.	ASTM D5293
CCS Scan	CCS viscosity values over a low-temperature range from 0°C to -50°. Indicates affects of low temperatures on startability over full range of scan. Reported in cP in the database and represented as a line graph in the IOM Primary Report.	ASTM D5293
Flash Point	Measures the temperature at which flammable fumes above the fluid will flash. Used in assessing the overall flammability hazard of an oil. Can indicate the possible presence of more volatile and flammable materials in relatively nonvolatile or nonflammable fluids. Reported in °C and °F.	ASTM D92
E85 Emulsion Retention	Bio-fuels like E85 have a greater tendency to form water contamination during engine operation which can negatively affect the lubrication and detergency of the engine oil. The test evaluates the ability of an engine oil, contaminated with a specified amount of water and simulated E85 fuel, to emulsify the water after agitation in a blender and to maintain this emulsion at temperatures of 20 °C to 25 °C and -5 °C to 0 °C for at least 24 h. (<i>Only conducted on samples claiming ILSAC GF-4 and GF-5 service categories.</i>)	ASTM D7563
Elemental Analysis by ICP	Analysis of broad range of elements (Al, Sb, Ba, B, Ca, Cr, Cu, Fe, Pb, Mg, Mo, Ni, P, Si, Ag, Na, Sn, Ti, Zn) using Inductively Coupled Plasma Emission Spectrometer (ICP). The test shows concentration of the foregoing metal and non-metal-containing components present in the engine oil formulation. Also provides information on some forms of contamination from additive processing and formulation. Reported in parts per million.	ASTM D4951
Foaming Characteristics	Determines the foaming characteristics of an oil at specified temperatures and conditions. Both the foaming tendency and stability of the foam are rated using Sequences I-IV and reported in mL and minutes, respectively.	ASTM D892 & ASTM D6082
Gelation Index and Gelation Index Temperature	Gives Gelation Index and Gelation Index Temperature using the Scanning Brookfield Technique. Determines the tendency of an oil to cause problems by forming a gelled structure at temperatures below 0°C (32°F). Also depicted graphically in the IOM Primary Report.	ASTM D5133
High Temp. High Shear Viscosity	High temperature, high shear rate viscosity using the Tapered Bearing Simulator (TBS) Viscometer determines the dynamic viscosity of engine oil at 100°C, 150°C and 10s ⁻¹ . Simulates the ability of an oil to meet the hydrodynamic needs of the engine in high shear areas. Reported in cP.	ASTM D4683
High Temp. High Shear Viscosity (Degraded)	High temperature, high shear rate viscosity using the Tapered Bearing Simulator (TBS) Viscometer after degrading the oil using the Fuel Injector Shear Stability Test (FISST). Determines the dynamic viscosity of oil at 100°C, 150°C and 10s ⁻¹ after permanent shear loss. Simulates the ability of an oil to withstand viscosity degradation and meet the hydrodynamic needs of the engine in high shear areas. Reported in cP.	ASTM D4683 & ASTM D5275
High Temp. Low Shear Viscosity	High temperature low shear viscosity using the Tannas Basic Rotary (TBR) Viscometer. Determines the dynamic viscosity of oil at 100°C, 150°C and 200s ⁻¹ . Helps to characterize the Viscosity Index improver used in a given engine oil. Reported in cP.	SAVLAB TBR
High Temp. Low Shear Viscosity (Degraded)	High Temperature Low Shear Viscosity using the Tannas Basic Rotary (TBR) Viscometer after degrading the oil using the Fuel Injector Shear Stability Test (FISST). Determines the dynamic viscosity of an oil at 100°C and 150°C and 200s ⁻¹ after permanent shear loss. Helps to characterize the Viscosity Index improver used in a given engine oil Reported in cP.	SAVLAB TBR & ASTM D5275

Kinematic Viscosity	Kinematic Viscosity at 40 °C and 100 °C. Reported in cSt.	ASTM D445
Kinematic Viscosity (Degraded)	Kinematic Viscosity at 100°C after degrading the oil using the Fuel Injector Shear Stability Test (FISST). Determines the kinematic viscosity of an oil after permanent shear loss. Reported in cSt.	ASTM D445 & ASTM D5275
MRV / TP-1	Low temperature, low shear viscosity using the Mini-Rotary Viscometer with a specified temperature profile. Predicts the ability of oil to permit satisfactory flow to the engine oil pump at the SAE specified temperature. Reported in cP. (<i>Not applicable with straight-grade samples.</i>)	ASTM D4684
Nitrogen	Nitrogen content by chemiluminescence. Measures the amount of nitrogen associated with ashless detergents. Reported in percent by weight.	ASTM D5762
Phosphorus Emission Index	Analysis of the volatilized oil to determine the amount of catalyst-contaminating phosphorus compounds volatilized with the oil. Reported as milligrams of phosphorus volatilized per liter of the engine oil tested..	SAVLAB PEI
Scanning Brookfield Viscosity	Low temperature, low shear viscosity using the Scanning Brookfield Technique (SBT). Predicts the ability of oil to permit satisfactory flow to the engine oil pump screen and to the pump over a range of cold temperatures. Reported in °C and cP. Also depicted graphically in the IOM Primary Report. (<i>Not applicable with straight-grade samples.</i>)	ASTM D5133
Sulfated Ash (Calculated)	Conversion of metal-containing components of a lubricant determined by ICP into metal sulfates and oxides. A measure of overall metallo-organic ash-forming components in a lubricant. Reported in percent by weight.	SAVLAB SULFCALC
Sulfur	Sulfur content by pyro-fluorescence. Measures the total amount of sulfur in the formulated engine oil. Reported in percent.	ASTM D5453
Sulfur Emission Index	Analysis of the volatilized oil to determine the amount of sulfur compounds volatilized with the oil. Reported in milligrams per liter of engine oil.	SAVLAB SEI
TEOST 33C	Thermo-Oxidation Engine Oil Simulation Test 33C. Measures the deposit-forming tendencies of an engine oil in the turbocharger at very high temperatures. Reported in milligrams of deposit on rod and on filter.	ASTM D6335
TEOST MHT	Thermo-Oxidation Engine Oil Simulation Test. Measures the deposit-forming tendencies of an oil at piston ring-pack operating temperatures. Reported in milligrams of deposit on rod and on filter. (<i>Not conducted on straight-grade or heavy-duty diesel engine oils.</i>)	ASTM D7097
TFOUT	Oxidation resistance by using the Thin Film Oxygen Uptake Test. Measures the length of time an oil withstands oxidation during exposure to oxygen at 160°C. Reported in minutes of resistance until the oxygen pressure falls sharply or the oil passes 500 minutes without overwhelming the anti-oxidant.	ASTM D4742
Viscosity-Dependent Fuel Efficiency Index	Uses the dynamic viscosity measurements to determine the projected fuel efficiency of an oil. Reported as an index value.	SAVLAB FEI
Viscosity Index	An empirical measure of the viscosity-temperature relationship. Used to determine the characteristics of base oils and the effects of VI Improvers. The value is determined from Kinematic Viscosity measurements at 40° and 100°C and a Viscosity Index Reference Book from the ASTM.	ASTM D2270
Viscosity Loss Profile	Uses the TBR, TBS, and FISST to determine the five forms of Temporary and Permanent Viscosity Losses gathered before and after shear degradation in the TBR, TBS, and FISST. Values are related to the molecular weight distribution of the VI Improver used in formulating and blending the engine oil. Also graphically depicted as viscosity trapezoids in the Viscosity Loss Profile section of the IOM Primary Report.	SAVLAB VLP
Volatility, GC by Simulated Distillation	Simulated Distillation by gas chromatography. Reports the percent oil volatilized at 371 °C (700°F). The CG chromatographic 'fingerprint' of the oil is provided in the IOM Primary Report.	ASTM D6417
Volatility, Noack	Volatility of the engine oil at 250°C using the non-Woods Metal version of the Noack. Measures percent oil volatilized during the test.	ASTM D5800