

# Schedule of Accreditation

issued by

## United Kingdom Accreditation Service

2 Pine Trees, Chertsey Lane, Staines-upon-Thames, TW18 3HR, UK



0261

Accredited to  
ISO/IEC 17025:2005

### SPECTRO

a trading name of Palace International Limited

Issue No: 033 Issue date: 19 January 2018

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Testing performed at the above address only

#### DETAIL OF ACCREDITATION

Materials/Products tested	Type of test/Properties measured/Range of measurement	Standard specifications/ Equipment/Techniques used
PETROLEUM and PETROLEUM PRODUCTS OIL, LUBRICANTS, DEBRIS AND HYDRAULIC FLUID	<p><u>Chemical and Physical Tests</u></p> <p>Air release value of lubricating and hydraulic oils - Range 0 - 30 mins</p> <p>Antioxidant content</p> <p>Apparent Viscosity (Cold Cranking Simulator) at -10, -15, -20, -25, -30 and -35 °C of Oils and Lubricants</p> <p>Blotter Spot test</p> <p>Colour (Lovibond) - Range 0 - 8 Lovibond units</p> <p>Conductivity</p> <p>Debris content extracted from filter elements - Range 0 - 100% wt</p> <p>Density and Specific Gravity - Range 0.5 - 1.5 g/ml</p> <p>Elemental analysis of dark oils - The following elements within spectral range 130 to 800 nm Ag, Al, B, Ba, Ca, Cd, Cl, Cr, Cu, Fe, K, Li, Mg, Mn, Mo, Na, Ni, P, Pb, S, Sb, Si, Sn, Ti, V, Zn</p>	<p>Documented In-House Methods in the series M 000 as listed below</p> <p>M 028 based on IP 313 and ASTM D3427</p> <p>In house method M039 based on ASTM 6971 by RULER</p> <p>ASTM D5293-17a</p> <p>ASTM D7899-13 (modified)</p> <p>M 009 based on IP 196, ISO 2049 and ASTM 1500</p> <p>M 021 based on ASTM D2624 and IP 274</p> <p>M 032 by filtration/SEM</p> <p>M 011 based on ASTM D5002</p> <p>M 019 based on ASTM D5185 By ICP-AES</p>



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PETROLEUM and PETROLEUM PRODUCTS OIL, LUBRICANTS, DEBRIS AND HYDRAULIC FLUID (cont'd)	<u>Chemical and Physical Tests</u> (cont'd)	Documented In-House Methods in the series M 000 as listed below
	Elemental analysis of Aviation oils - The following elements within spectral range 130 to 800 nm; Ag, Al, B, Be, Ca, Cl, Cr, Cu, Fe, K, Li, Mg, Mn, Mo, Na, Ni, P, Pb, S, Sb, Si, Sn, Ti, V, W, Zn	M 019 AES based on ASTM D5185 By ICP-AES
	Elemental analysis of Oils Ag, Al, Ba, B, Ca, Cr, Cu, Fe, K, Mg, Mn, Mo, Na, Ni, P, Pb, S, Si, Sn, Ti, V, Zn	ASTM D5185-13e1 By ICP-AES
	Elemental Analysis of additive elements in Lubricating Oil Ba, B, Ca, Cu, Mg, Mo, P, S, Zn	ASTM D4951-14 By ICP-AES
	Evaporation Test (NOACK) of oils and lubricants	CEC-40-93
	Ferromagnetic particles in oil - Range 15 - 750 PQ units	M 025 by Particle Quantifier
	Flash Point - Range 120 - 300 °C	M 001 by Go, No-go based on IP 303:Part 1 (obsolete) by Setaflash or based on IP303 / ASTM D7094 Eralytics Automatic Closed cup
	- Range 80 - 300 °C	M 020 by Cleveland open cup based on ASTM D92 and IP 36 by Cleveland Open Cup
- Range 40 - 360 °C	M 031 by Pensky Marten closed cup based on IP 34 and ASTM D93	
Foaming characteristics of lubricants - Range 0 ml (nil) to <1000 ml	M 027 based on IP 146 and ASTM D892 using Seta Dual-twin foam bath	



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PETROLEUM and PETROLEUM PRODUCTS OIL, LUBRICANTS, DEBRIS AND HYDRAULIC FLUID (cont'd)	<u>Chemical and Physical Tests</u> (cont'd)	Documented In-House Methods in the series M 000 as listed below
	Chlorofluoro Hydrocarbons in hydraulic fluids - range: Freon 11 0.1 to 5 ppm Freon 113 0.1 to 10 ppm 1,1,1-trichloroethane 0.1 to 20 ppm Carbon tetrachloride 0.1 to 10 ppm 1,1,2-trichloroethylene 0.1 to 10 ppm 1,1,2,2-tetrachloroethylene 0.1 to 5 ppm	M 018 by Gas Chromatography
	HTHS (Dynamic Viscometry) at 100 and 150°C of Oils and Lubricants	CEC L-36-90 by Ravenfield High Shear Rate Tapered Plug viscometer
	Insoluble Matter: - heptane or toluene Range 0.01 - 20 % w/w	M 003 by High Speed Centrifuge based on IP 316
	Pentane - Range 0.01 - 5 % w/w	M 010 by Membrane Filtration based on MM 1068
	Metallic debris	M 022 by Chemical analysis
	Micro carbon residue - Range 0.10 % - 30.0 % m/m	M 030 based on ASTM D4530
	Neutralization number: Acid - Range 0.01 - 20.0	M 034 by colour titration based on IP 139 and ASTM D974
	Nitrogen in Oils and Lubricants	ASTM D5762-12 (2017) by combustion and chemiluminescence
	Nitrogen in Oils and Lubricants  TAN Range 0.1 - 20 mg KOH/g	ASTM D5291-16 by Nitrogen analyser  M 007 based on ASTM D664 and IP 177



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	Total Base Number (TBN) - Range 0.1 - 60 mg KOH/g	M 004 based on ASTM D4739 M 005 based on ASTM D664 and IP 177
	- Range 0.1-60 mg KOH/g	M 006 based on IP 276 and ASTM D2896-11
	- Range 0.1-300 mg KOH/g	ASTM D2896-15 by Metrohm titrator
	- Range 0.1-250 mg KOH/g	ASTM D4739-11 (2017) by Metrohm titrator
	Oxidation, nitration, sulphates, glycol, water	
	spectral range 7400 - 375 cm <sup>-1</sup> - Glycol POS/NEG - Oxidation 0 - 50 (abs/cm) - Nitration 0 - 50 (abs/cm) - Water 0 - 5 (% by wt) - Soot 0 - 2 (% by wt)	M 017 by FTIR
	Particle counting (contamination) NAS code 0-12	M 008 based on IP 327 (obsolete), NAS 1638, ISO 4406 by HIAC
	Particle examination - qualitative identification of alloy Type	M 013 by Scanning Electron Microscope
	Size and number of particles Range 5 - 100 microns	M 033 by HIAC
Initial pH Range 0-14 pH units	M 016	
Sulphated Ash in Oils and Lubricants	ASTM D874-13a	
Sulphur	ASTM D2622-16 by WDXRF	



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PETROLEUM and PETROLEUM PRODUCTS OIL, LUBRICANTS, DEBRIS AND HYDRAULIC FLUID (cont'd)	<u>Chemical and Physical Tests</u> (cont'd)  Viscosity Range 1-1000 cSt  Viscosity at 40°C and 100°C  Viscosity Index calculated from viscosity results at 40°C and 100°C  Water Content - Range 0.001 - 10% or 10 - 100,000 ppm  Water contamination, positive or negative - crackle test	Documented In-House Methods in the series M 000 as listed below  M 002 based on IP 71, Section 1, by Semi-Automatic Viscometer Method, ASTM D445  ASTM D445-17a By Manual and automated viscometers  ASTM D2270-10 (2016)  M 023 by automatic Karl Fischer based on ASTM D6304c  M 026 by Seta Flash Go, No-go flashpoint tester
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