

# 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: 031 Issue date: 18 January 2017

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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<br>OIL, LUBRICANTS, DEBRIS AND HYDRAULIC FLUID | <u>Chemical and Physical Tests</u><br><br>Air release value of lubricating and hydraulic oils<br>- Range 0 - 30 mins<br><br>Antioxidant content<br><br>Apparent Viscosity (Cold Cranking Simulator) at -10, -15, -20, -25, -30 and -35 °C of Oils and Lubricants<br><br>Blotter Spot test<br><br>Colour (Lovibond)<br>- Range 0 - 8 Lovibond units<br><br>Conductivity<br><br>Debris content extracted from filter elements<br>- Range 0 - 100% wt<br><br>Density and Specific Gravity<br>- Range 0.5 - 1.5 g/ml<br><br>Elemental analysis of dark oils<br>- The following elements within spectral range 130 to 800 nm<br>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 | Documented In-House Methods in the series M 000 as listed below<br><br>M 028 based on IP 313 and ASTM D3427<br><br>In house method M039 based on ASTM 6971 by RULER<br><br>ASTM D5293-15<br><br>In house method based on ASTM D7899 (modified)<br><br>M 009 based on IP 196, ISO 2049 and ASTM 1500<br><br>M 021 based on ASTM D2624 and IP 274<br><br>M 032 by filtration/SEM<br><br>M 011 based on ASTM D5002<br><br>M 019 based on ASTM D5185<br>By ICP-AES |



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| PETROLEUM and PETROLEUM PRODUCTS<br>OIL, LUBRICANTS, DEBRIS AND HYDRAULIC FLUID (cont'd) | <u>Chemical and Physical Tests</u><br>(cont'd)   | Documented In-House Methods in the series M 000 as listed below  |
|  | Elemental analysis of Aviation oils<br>- The following elements within spectral range 130 to 800 nm;<br>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<br>By ICP-AES  |
|  | Elemental analysis of Oils<br>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<br>By ICP-AES  |
|  | Elemental Analysis of additive elements in Lubricating Oil<br>Ba, B, Ca, Cu, Mg, Mo, P, S, Zn  | ASTM D4951-14<br>By ICP-AES  |
|  | Evaporation Test (NOACK) of oils and lubricants  | CEC-40-93  |
|  | Ferromagnetic particles in oil<br>- Range 15 - 750 PQ units  | M 025 by Particle Quantifier   |
|  | Flash Point<br>- Range 120 - 300 °C  | M 001 by Go, No-go based on IP 303:Part 1 (obsolete) by Setaflash<br>or<br>based on IP303 / ASTM D7094 Eralytics Automatic Closed cup              |
|  | - Range 80 - 300 °C<br><br>- Range 40 - 360 °C   | M 020 by Cleveland open cup based on ASTM D92 and IP 36 by Cleveland Open Cup<br><br>M 031 by Pensky Marten closed cup based on IP 34 and ASTM D93 |
| Foaming characteristics of lubricants<br>- 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<br>OIL, LUBRICANTS, DEBRIS AND HYDRAULIC FLUID (cont'd) | <u>Chemical and Physical Tests</u><br>(cont'd)  | Documented In-House Methods in the series M 000 as listed below               |
|  | Chlorofluoro Hydrocarbons in hydraulic fluids<br>- range:<br>Freon 11 0.1 to 5 ppm<br>Freon 113 0.1 to 10 ppm<br>1,1,1-trichloroethane<br>0.1 to 20 ppm<br>Carbon tetrachloride<br>0.1 to 10 ppm<br>1,1,2-trichloroethylene<br>0.1 to 10 ppm<br>1,1,2,2-tetrachloroethylene<br>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 Sheer Rate Tapered Plug viscometer             |
|  | Insoluble Matter:<br>- heptane or toluene<br>Range 0.01 - 20 % w/w  | M 003 by High Speed Centrifuge based on IP 316                                |
|  | Pentane<br>- 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<br>- Range 0.10 % - 30.0 % m/m   | M 030 based on ASTM D4530   |
|  | Neutralization number:<br>Acid<br>- 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 by combustion and chemiluminescence                             |
|  | Nitrogen in Oils and Lubricants<br><br>TAN<br>Range 0.1 - 20 mg KOH/g   | ASTM D5291-16 by Nitrogen analyser<br><br>M 007 based on ASTM D664 and IP 177 |



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| PETROLEUM and PETROLEUM PRODUCTS<br>OIL, LUBRICANTS, DEBRIS AND HYDRAULIC FLUID (cont'd) | <u>Chemical and Physical Tests</u><br>(cont'd)  | Documented In-House Methods in the series M 000 as listed below  |
|  | Total Base Number (TBN)<br>- Range 0.1 - 60 mg KOH/g  | M 004 based on ASTM D4739<br>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 by Metrohm titrator                                |
|  | Oxidation, nitration, sulphates, glycol, water  |  |
|  | spectral range 7400 - 375 cm <sup>-1</sup><br>- Glycol POS/NEG<br>- Oxidation 0 - 50 (abs/cm)<br>- Nitration 0 - 50 (abs/cm)<br>- Water 0 - 5 (% by wt)<br>- Soot 0 - 2 (% by wt) | M 017 by FTIR  |
|  | Particle counting (contamination)<br>NAS code 0-12  | M 008 based on IP 327 (obsolete), NAS 1638, ISO 4406 by HIAC     |
|  | Particle examination<br>- qualitative identification of alloy Type  | M 013 by Scanning Electron Microscope                            |
|  | Size and number of particles<br>Range 5 - 100 microns   | M 033 by HIAC  |
| Initial pH<br>Range 0-14 pH units  | M 016   |  |
| Sulphated Ash in Oils and Lubricants   | ASTM D874-13a   |  |
| Sulphur and Chlorine   | M 015 by X-Ray Spectrometry (MDX) - adapted from ASTM D2622   |  |



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| END  |   |   |