# Shell Aviation

## *Aero*Shell Lubricants and Special Products

### SHELF LIFE, PERIODIC PRODUCT INSPECTION AND RE-TESTING

It is very important that no misunderstanding should ever arise over the contents of a container. Issue of an incorrect product from the warehouse should be prevented at all costs - especially for aviation applications. Great care must therefore be taken to ensure that the right product is received in the first instance. Furthermore, after products have been received, markings on containers and cartons should be kept legible; if necessary, they should be re-stencilled or re-labelled.

If a product is in store for a prolonged period of time, it is important to determine that it is still suitable for use.

At regular intervals (exact time is for the user's decision, but it could be every quarter or every six months) a visual inspection of the outside of the cartons (for small packs) or containers (if drums or pails) should be undertaken checking for signs of leaks or damage. Those containers that are leaking or are badly damaged should be downgraded for non-aviation use or destroyed in accordance with local environmental regulations.

If product is still in stock after a number of years then it is necessary to take samples and test key properties to verify that the product continues to be fit for purpose.

For the majority of *Aero*Shell grades, representative samples from each batch should be re-tested after the specified time from date of manufacture or, if not known, date of order or date of receipt can be used as the best estimate.

Different products are subject to different re-test periods; similarly, the tests that need to be carried out on a product, to verify its continued suitability for use, depend on the type of product and field experience developed over the years. The re-test periods and the testing required for *Aero*Shell products are based primarily on those specified in the NATO Standardization Agreement STANAG 3149 (Edition 8) entitled “Minimum Quality Surveillance of Petroleum Products”. Details of these re-test periods and testing requirements are contained in the tables that follow. In summary, the re-test periods for AeroShell products are as follows:

| Product | Initial Retest Period (years) |
|---|---|
| All piston engine oils | 4 |
| All turbine engine oils | 4 |
| All greases | 3 |
| Hydraulic fluids – AeroShell Fluids 4, 31, 41, 51 | 3 |
| Hydraulic fluids – AeroShell Fluids 61, 71, LGF, SSF | 4 |
| AeroShell Fluids 1, 2F, 2T 2XN, 3, 5L-A, 5M-A, 12, 18 | 4 |
| AeroShell Fluids 602, 634, S.8350 | 3 |
| AeroShell Compounds 02, 05, 06A | 4 |
| AeroShell Compound 07 | 2 |
| AeroShell Calibrating Fluid 2 | 2 |

Every package of an AeroShell product will be marked with a batch number and a Date of Manufacture (DoM). When a batch of product is manufactured, it is fully tested according to the specification requirements and a batch Certificate of Analysis (CoA) bearing the date of manufacture is produced. This "parent" batch may then be filled into a variety of packages over the following days, weeks or (rarely) months. For traceability reasons, it is important that each filling operation has its own batch number and fill date (with records kept to link each filling operation to the parent batch and

its CoA). Thus the fill date is, in effect, the "date of manufacture" of that particular package and it is this date from which the re-test period is calculated.

If a parent batch is in storage for more than a few weeks after manufacture before being filled into the final package, then a small amount of re-testing will be done to re-confirm the key properties of the batch prior to filling. This precaution reinforces the use of fill date, rather than original manufacturing date, for the marking of containers and calculation of re-test period. Normally, packages will display "Re-test date: x years after Date of Manufacture" rather than the re-test date itself.

The STANAG 3149 document (para 33) specifies the re-test periods and adds the following restriction:

> Packed petroleum products do not have an indefinite shelf life. The procedure for re-lifing petroleum products shall be as follows:
> The first re-test date shall be at the original frequency stated in the tables. Subsequent re-tests shall follow at half that frequency.

These restrictions have been applied to *Aero*Shell products.

For example, the tables show that the original re-test period for *Aero*Shell Oil W100 is 4 years; thus the first re-test is due 4 years after date of manufacture with the next re-test 2 years later, with subsequent re-tests following every 2 years thereafter.

Normally there is no requirement to do a full specification test since in many specifications there are tests that are difficult/complex to do or which involve specialised hardware. Generally, these can only be done by an oil products laboratory that specialises in aviation oils and greases. Instead, a reduced set of tests is specified for each product focusing on those properties which would reveal any deterioration that has occurred in the product over the period in storage. In some cases the cost of re-testing can be higher than the value of the product in stock and in such situations it is doubtful that it makes economic sense to re-test the product. Where re-testing is undertaken then samples from each and every batch involved must be taken according to the cube root rule (see attached table).

All testing must be conducted using the test methods called for in the specification for that product (see below). All re-test results should be compared with the minimum/maximum limits in the relevant specification and, importantly, with the original Certificate of Analysis (CoA) for that batch, to determine if there are any significant changes since the product was packed. If the batch CoA is not available, typical values as published in the *Aero*Shell Book or other *Aero*Shell publications can be used as a guide. Based on this comparison, a decision can then be made as to the suitability of the product for continued use or whether further testing is required, or whether the product should be downgraded or discarded.

TO SUM UP

In general, *Aero*Shell products are inherently stable. If stored properly, their quality, properties and performance should not be affected by prolonged storage.

For greatest economic efficiency, stock levels and re-order level/frequency should be commensurate with market demand and products should be issued from the warehouse in the order in which they were received:

> in other words: FIRST IN - FIRST OUT!

If, for some reason, a product has to be stored for longer than is economically desirable, and some doubt arises about its quality, it is recommended that Shell technical staff should be contacted for information about the product's continued usefulness for aviation applications.

## Sampling of Packed Stock of *Aero*Shell Lubricants and Special Products

The number of packages* to be sampled shall not be less than the cube root of the total number of containers in the batch. A list of guide numbers is given below. Sampling should be at random throughout the batch.

| Number of packages* | Number to be sampled | Number of packages* | Number to be sampled |
|---|---|---|---|
| 1 | 1 | 1332 – 1728 | 12 |
| 2 – 8 | 2 | 1729 – 2197 | 13 |
| 9 – 27 | 3 | 2198 – 2744 | 14 |
| 28 – 64 | 4 | 2745 – 3375 | 15 |
| 65 – 125 | 5 | 3376 – 4096 | 16 |
| 126 – 216 | 6 | 4097 – 4913 | 17 |
| 217 – 343 | 7 | 4914 – 5823 | 18 |
| 344 – 512 | 8 | 5933 – 6859 | 19 |
| 513 – 729 | 9 | 6860 – 8000 | 20 |
| 730 – 1000 | 10 | 8001 – 9261 | 21 |
| 1001 – 1331 | 11 | 9262 – 10648 | 22 |

*Note: a carton, e.g. 24x1L tins, 4x3kg tins, etc. constitutes 1 package (provided all the tins in the carton are from the same batch).

## Test Methods to be used in Re-Testing

The test methods used for re-testing should be the same as those listed in the specification for that product. The majority of these specifications can be downloaded, without charge, via the Internet.

### US MIL Specifications and QPLs

The US Department of Defense site is http://assist.daps.dla.mil/quicksearch/

In the Document Number box, type the specification number (e.g. 23699).

Press Submit. The system will then list all specifications and QPLs with that number. (Note: there may be several documents listed which incorporate this number, so you need to be sure to choose the correct one). Click the one you require; follow through until the document itself downloads as an Adobe Acrobat file which can be saved and/or printed.

### UK MoD Defence Standards (DEF STANs)

The UK Ministry of Defence site is http://www.dstan.mod.uk/

On blue menu bar across the top of the screen, choose “Standards” and click “Defence Standards” on the drop-down menu.

Accept the disclaimer.

From the Index, choose the appropriate class e.g. 91 for Fuels & Lubricants.

Listed standards can be downloaded as Acrobat files and saved and/or printed.

Alternatively, you can use the Search Box to go straight to a particular specification.

Shell Aviation – OIA/212

# Re-Test Requirements for *Aero* Shell Products

**Sheet 1 - Engine Oils - Aviation/Piston; Engine Oils - Aviation/Turbine (Mineral)**

| **Product** | **ASO 65,80,100,120** | **ASO W65, W80, W100, W120** | **ASO W 15W-50** | **ASO W100Plus** | **ASO D 10W-40** | **ASTO 2** | **ASTO 3** | **ASTO 3SP** |
|---|---|---|---|---|---|---|---|---|
| Product Code(s) | 001A0072,001A0073,001A0070,001A0071 | 001A0076,001A0077, 001A0074,001A0075 | 001A9612 | 001A9642 | 001B0741 | 001A0904 | 001A0079 | 001A0082 |
| Specification | SAE J-1966 | SAE J-1899 | SAE J-1899 | SAE J-1899 | - | MIL-PRF-6081D | DEF STAN 91-99/2 | OST 38.001163 |
| NATO Code No. | O-113,O-115,O-117,- | -, O-123,O125,O-128 | O-162 | - | - | O-133 | O-135 | |
| Joint Service Designation(s) | OM-107,OM-170, OM-270,OM-370 | -, OMD-160, OMD-250, OMD-370 | OMD-162 | - | - | OM-10 | OM-11 | |
| **Re-Test Frequency (years)** | **4** | **4** | **4** | **4** | **4** | **4** | **4** | **4** |
| **Test Requirements** | | | | | | | | |
| Appearance | x | x | x | x | x | x | x | x |
| Pour Point | x | x | x | x | x | x | x | x |
| Viscosity at 100ºC | x | x | x | x | x | | | |
| Viscosity at 40ºC | | | | | | x | x | x |
| TAN | x | x | x | x | TBN | x | x | x |
| Precipitation No (or sedimentation) | x | x | x | x | | x | | |
| Foaming | | x | x | x | | | | |
| Ash Content | x | x | x | x | x | | x | x |
| Copper Corrosion | x | x | x | x | | x | x | x |
| Colour | | | | | | x | | |

**The above tests are to be carried out in accordance with the appropriate specification**

# Re-Test Requirements for *Aero* Shell Products

**Sheet 2 - Engine Oils - Aviation/Turbine (Synthetic)**

| **Product** | **ASTO 308** | **ASTO 390** | **ASTO 750** | **ASTO 500/529** | **ASTO 531** | **ASTO 555** | **ASTO 560** |
|---|---|---|---|---|---|---|---|
| Product Code | 001A0080 | 001A0081 | 001A0086 | 001A0083/001A0912 | 001A0913 | 001A0084 | 001A0085 |
| Specification | MIL-PRF-7808L | DEF STAN 91-94/2 | DEF STAN 91-98/2 | MIL-PRF-23699F | MIL-PRF-23699F | DEF STAN 91-100/3 | MIL-PRF-23699F |
| NATO Code No. | O-148 | | O-149 | O-156 | O-152 | O-160 | O-154 |
| Joint Service Designation | OX-9 | OX-7 | OX-38 | OX-27 | | OX-26 | |
| **Re-Test Frequency (years)** | **4** | **4** | **4** | **4** | **4** | **4** | **4** |
| **Test Requirements** | | | | | | | |
| Appearance | x | x | x | x | x | x | x |
| Pour Point | | | | | | x | |
| Viscosity at 100ºC | x | x | x | x | x | x | x |
| Viscosity at -40ºC | | x | x | | | | |
| Viscosity at -51ºC | x | | | | | | |
| TAN | x | x | x | x | x | x | x |
| Precipitation No | x | | | | | | |
| Foaming | x | | x | | | | |

**The above tests are to be carried out in accordance with the appropriate specification**

# Re-Test Requirements for *Aero* Shell Products

**Sheet 3 - Hydraulic Fluids (aviation)**

| **Product** | **ASF 4** | **ASF 41** | **ASF 31** | **ASF 51** | **ASF 61** | **ASF 71** | **LGF** | **SSF** |
|---|---|---|---|---|---|---|---|---|
| Product Code | 001A0049 | 001A0050 | 001A0048 | 001A0908 | 001A0053 | 001A0055 | 001A0069 | 001A0078 |
| Specification | DEF STAN 91-48/2 | MIL-PRF-5606H | MIL-PRF-83282D | MIL-PRF-87257A | MIL-PRF-46170D | MIL-PRF-6083F | BMS 3-32A | BMS 3-32A |
| NATO Code No. | H-520 | H-515 | H-537 | H-538 | H-544 | C-635 | | |
| Joint Service Designation | OM-18 | OM-15 | OX-19 | OX-538 | | PX-26 | | |
| **Re-Test Frequency (years)** | **3** | **3** | **3** | **3** | **4** | **4** | **4** | **4** |
| **Test Requirements** | | | | | | | | |
| Appearance | x | x | x | x | x | x | x | x |
| Pour Point | x | x | x | x | | | | |
| Flash Point | | | | | x | x | | |
| Viscosity at 40ºC | x | x | | | x | x | x | x |
| Viscosity at -40ºC | | | x | x | x | | | |
| TAN | x | x | x | x | | x | x | x |
| Copper Corrosion | x | x | | | x | | | |
| Particulate Contamination | | x | x | x | | x | | |
| Corrosion | | | | | | x | | |
| Protection | | | | | | x | | |
| Foaming | | | | | x | | | |
| Zinc content | | | | | | | x | x |
| Colour | x | x | x | x | x | x | x | x |

**The above tests are to be carried out in accordance with the appropriate specification**

# Re-Test Requirements for *Aero* Shell Products

| **Sheet 4 - Transmission Fluids (aviation)** | | | | |
|---|---|---|---|---|
| | | | | |
| **Product** | **ASF 5L-A** | **ASF 5M-A** | **ASF S.8350** | |
| Product Code | 001A0051 | 001A0952 | 001A0911 | |
| Specification | MIL-PRF-6086E | MIL-PRF-6086E | DTD900/4981A | |
| NATO Code No. | O-153 | O-155 | | |
| Joint Service Designation | OEP-30 | OEP-70 | OEP-215 | |
| | | | | |
| **Re-Test Frequency (years)** | **4** | **4** | **3** | |
| | | | | |
| **Test Requirements** | | | | |
| Appearance | x | x | x | |
| Pour Point | x | x | x | |
| Viscosity at 40ºC | x | x | x | |
| TAN | x | x | x | |
| Copper Corrosion | x | x | x | |
| | | | | |
| | | | | |
| **The above tests are to be carried out in accordance with the appropriate specification** | | | | |

| Re-Test Requirements for *Aero* Shell Products | | | | | | | |
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| **Sheet 5 - Speciality Lubricants (aviation) - Page 1** | | | | | | | |
| | | | | | | | |
| **Product** | **ASF 1** | **ASF 2F** | **ASF 2T** | **ASF 2XN** | **ASF 3** | **ASF 12** | **ASF 18** |
| Product Code | 001A0039 | 001A0044 | 001A0045 | 001A0046 | 001A0047 | 001A0041 | 001A0043 |
| Specification | DEF STAN 91-44 | MIL-C-6529C | MIL-C-6529C | MIL-C-6529C | MIL-PRF-7870C | MIL-PRF-6085D | MIL-PRF-32033 |
| NATO Code No. | O-134 | C-609 | C-610 | C-608 | O-142 | O-147 | O-190 |
| Joint Service Designation | OM-13 | OX-270 | ZX-17 | ZX-21 | OM-12 | OX-14 | OX-18 |
| | | | | | | | |
| **Re-Test Frequency (years)** | **4** | **4** | **4** | **4** | **4** | **4** | **4** |
| | | | | | | | |
| **Test Requirements** | | | | | | | |
| Appearance | x | x | x | x | x | x | x |
| Pour Point | | | | | x | x | |
| Flash Point | | | | | | | |
| Viscosity at 40ºC | x | | | | x | x | x |
| Viscosity at 54.4ºC | | | | | | x | |
| Viscosity at 100ºC | | | | | | | |
| Viscosity at -54ºC | | | | | | x | |
| TAN | | | | | x | x | |
| Copper Corrosion | x | | | | x | | x |
| Particulate Contamination | | | | | | | |
| Corrosion | | | | | | | |
| Protection | | x | x | | x | x | |
| Stability (high & low temp) | | x | x | | | | |
| Oxidation | | | | | | x | |
| Precipitation No. | | x | x | | | | |
| Water Content | | | | | | | |
| Load Carrying Capability | | | | | | | |
| | | | | | | | |
| **The above tests are to be carried out in accordance with the appropriate specification** | | | | | | | |

| Re-Test Requirem | | | | | |
|---|---|---|---|---|---|
| **Sheet 5 - Speciality Lubricants - Page 2** | | | | | |
| | | | | | |
| **Product** | **ASF 602** | **ASF 634** | | | **ASF CF2** |
| Product Code | 001A0909 | 001A0910 | | | 001A0032 |
| Specification | MIL-PRF-87252C | MIL-PRF-63460D | | | MIL-PRF-7024E |
| NATO Code No. | S-1748 | S-758 | | | |
| Joint Service Designation | | | | | |
| | | | | | |
| **Re-Test Frequency (years)** | **3** | **3** | | | **2** |
| | | | | | |
| **Test Requirements** | | | | **Test Requirements** | |
| Appearance | x | x | | Appearance | x |
| Pour Point | | x | | Relative Density | x |
| Flash Point | | x | | Viscosity at 37.8ºC | x |
| Viscosity at 40ºC | | x | | Existent gum | x |
| Viscosity at 54.4ºC | | | | Distillation IBP | x |
| Viscosity at 100ºC | | x | | Distillation FBP | x |
| Viscosity at -54ºC | | x | | Flash Point | x |
| TAN | x | | | Particulate matter | x |
| Copper Corrosion | | | | Copper Corrosion | x |
| Particulate Contamination | | | | Total acidity | x |
| Corrosion | | | | | |
| Protection | | | | | |
| Stability (high & low temp) | | | | | |
| Oxidation | | | | | |
| Precipitation No. | | | | | |
| Water Content | x | | | | |
| Load Carrying Capability | | x | | | |
| | | | | | |
| **The above tests are to be carrie** | | | | | |

# Re-Test Requirements for *Aero* Shell Products

| **Sheet 7 - Aviation Greases** | **- Page 1** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| **Product** | **ASG 5** | **ASG 6** | **ASG 7** | **ASG 11MS** | **ASG 14** | **ASG 15** | **ASG 16** | **ASG 17** | **ASG 22/22CF** |
| Product Code | 001A0063 | 001A0064 | 001A0065 | 001A906 | 001A0914 | 001A0835 | 001A0057 | 001A0058 | 001A0059/00836 |
| Specification | MIL-G-3545C | MIL-PRF-24139A | MIL-PRF-23827C | | MIL-G-25537C | MIL-G-25013E | MIL-G-25760A | MIL-G-21164D | MIL-PRF-81322G |
| NATO Code No. | G-359 | G-450/G-382 | G-354 | | G-366 | G-372 | G-361 | G-353 | G-395 |
| Joint Service Designation | XG-227 | XG-274/271 | | | XG-284 | XG-300 | XG-292 | | XG-293 |
| | | | | | | | | | |
| **Re-Test Frequency (years)** | **3** | **3** | **3** | **3** | **3** | **3** | **3** | **3** | **3** |
| | | | | | | | | | |
| **Test Requirements** | | | | | | | | | |
| Appearance (including visual oil separation) | x | x | x | x | x | x | x | x | x |
| Penetration (worked) | x | x | x | x | x | x | x | x | x |
| Working stability | | x | x | x | x | x | | x | x |
| Copper Corrosion | x | x | x | x | x | x | x | x | x |
| Steel Corrosion | | | | | | | | | |
| Dropping point | x | x | x | x | x | x | x | x | x |
| Odour | x | x | x | x | x | x | x | x | x |
| Oil Separation | x | x | x | x | x | x | x | x | x |
| Rust Preventative Properties | | | x | x | x | x | | x | x |
| Resistance to aqueous solutions | | | | | | | | | |
| Fuel resistance | | | | | | | | | |
| | | | | | | | | | |
| **The above tests are to be carried out in accordance with the appropriate specification** | | | | | | | | | |

| Re-Test Requirements fo | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Sheet 7 - Aviation Greases** | **- Page 2** | | | | | | |
| | | | | | | | |
| **Product** | **ASG 23C** | **ASG 33** | **ASG 33MS** | **ASG 43C** | **ASG S.4768** | **ASG S.7108** | **ASC 08** |
| Product Code | 001A0061 | 001A0903 | 001B1683 | 001A0062 | 001A0067 | 001A0068 | 001A0907 |
| Specification | MIL-G-81827A | MIL-PRF-23827C | MIL-G-21164D | SAE-AMS-G-4343 | DEF STAN 80-81/3 | SAE-AMS-G-6032 | SAE-AMS 2518A |
| NATO Code No. | | G-354 | G-353 | G-392 | S-722 | G-363 | S-720 |
| Joint Service Designation | | XG-287 | XG-276 | XG-269 | ZX-38 | XG-235 | ZX-13 |
| | | | | | | | |
| **Re-Test Frequency (years)** | **3** | **3** | **3** | **3** | **3** | **3** | **3** |
| | | | | | | | |
| **Test Requirements** | | | | | | | |
| Appearance (including visual oil separation) | x | x | x | x | x | x | x |
| Penetration (worked) | x | x | x | x | x | x (unworked) | x |
| Working stability | x | x | x | | | | |
| Copper Corrosion | x | x | x | x | x | x | |
| Steel Corrosion | | | | | | | |
| Dropping point | x | x | x | x | | x | |
| Odour | x | x | x | x | | x | |
| Oil Separation | x | x | x | x | | x (visual) | |
| Rust Preventative Properties | x | x | x | x | | | |
| Resistance to aqueous solutions | | | | | | x | |
| Fuel resistance | | | | | | x | |
| | | | | | | | |
| **The above tests are to be carried out in a** | | | | | | | |

# Re-Test Requirements for *Aero* Shell Products

**Sheet 6 - Speciality Lubricants (aviation) - Page 3**

| **Product** | **ASC 02** | **ASC 05** | **ASC 06A** | **ASC 07** |
|---|---|---|---|---|
| Product Code | 001A0033 | 001A0034 | 001A0036 | 001A0037 |
| Specification | DEF STAN 80-217 | DEF STAN 80-85 | BS.1595 | DTD.406B |
| NATO Code No. | C-614 | C-628 | S-737 | S-745 |
| Joint Service Designation | PX-1 | PX-11 | AL-11 | AL-5 |
| | | | | |
| **Re-Test Frequency (years)** | **4** | **4** | **4** | **2** |
| | | | | |
| **Test Requirements** | | | | |
| Appearance | x | x | x | x |
| Acidity | | | x | |
| Relative Density | | | x | x |
| pH value | | | | x |
| Water Content | | | | x |
| Copper Corrosion | x | x | | |
| Film Appearance | x | | | |
| Drying Rate | x | | | |
| Melting Point | | x | | |
| Stability of wax dispersion | x | x | | |
| Ash Content | x | | | |
| Penetration (worked) | | x | | |

**The above tests are to be carried out in accordance with the appropriate specification**