



AEROSPACE RECOMMENDED PRACTICE

ARP6299™**REV. A**Issued 2020-09
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Superseding ARP6299

Procedure for Thermal Aging Test for Polyol Ester Gas Turbine Engine Lubricants

RATIONALE

SAE Five-Year Review. This thermal aging assessment procedure (initially developed by Safran Helicopter Engines, formerly Turbomeca) was designed to evaluate the physical and/or chemical properties and lubricant aging behavior of gas turbine lubricants.

1. SCOPE

This method is intended to evaluate the thermal and oxidative stability of synthetic, ester-based aviation lubricants under defined conditions of time and temperature. This method is applicable to lubricants meeting the compositional and performance requirements of AS5780.

2. APPLICABLE DOCUMENTS

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 1-877-606-7323 (U.S. and Canada only) or 1-724-776-4970 (outside U.S. and Canada), www.sae.org.

ARP5088 Test Method for the Determination of Total Acidity in Polyol Ester and Diester Gas Turbine Lubricants by Automatic Potentiometric Titration

AS5780 Specification for Aero and Aero-Derived Gas Turbine Engine Lubricants

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2.2 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9500, www.astm.org.

- ASTM D92 Standard Test Method for Flash and Fire Points by Cleveland Open Cup Tester
- ASTM D445 Standard Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and Calculation of Dynamic Viscosity)
- ASTM D4052 Standard Test Method for Density, Relative Density, and API Gravity of Liquids by Digital Density Meter
- ASTM D6971 Standard Test Method for Measurement of Hindered Phenolic and Aromatic Amine Antioxidant Content in Non-zinc Turbine Oils by Linear Sweep Voltammetry

3. OUTLINE OF METHOD

A measured amount of the sample is placed in the glass flask, and the apparatus is assembled. The sample is heated with stirring at a specified temperature for a specified period of time. Aliquots are periodically removed and analyzed. The apparatus is disassembled, and the remaining sample is drained from the flask. An aliquot from the end-of-test sample is analyzed. The flask and the stirrer are inspected and photographed. The analytical results are reported.

4. APPARATUS

4.1 Glassware and Accessories

- 4.1.1 The glassware and test setup assembly are shown in Figure A1. The components are listed below, with part numbers from H.S. Martin in many cases. Suppliers of the other equipment items are noted. Equivalent components from other suppliers are acceptable.
- 4.1.2 Thermometer well adapter, PTFE, 14/20 (001048-1420).
- 4.1.3 Allihn condenser, 400 mm 29/42 (458300-2940).
- 4.1.4 Flask (4000 mL) with 100 mm Duran Flange (620340-9007).
- 4.1.5 Cover, 100 mm Duran Flange, 4 neck (620685-9046).
- 4.1.6 Stirrer bearing, 10 mm 29/32 (785554-9001).
- 4.1.7 Stirrer shaft, 10 x 25 mm, stainless steel (787150-9002). An example is a stirrer blade 8 mm wide and 60 mm long when extended.
- 4.1.8 Stopper, hollow 29/26 (850500-2926).
- 4.1.9 Drying tube, 24/40 (Ace Glass, Inc. Order Code 5170-10).
- 4.1.10 Heating mantle, 4000 mL (726000-9001).
- 4.1.11 Clamp, quick release, 100 mm (613710-0100).
- 4.1.12 PTFE probe adapter for J-KEM Temperature Controller (Sigma-Aldrich Part No. Z248282-1).

4.2 Controllers and Support Equipment

The preferred controlling and support equipment are listed below. Equivalent components from other suppliers are acceptable.

- 4.2.1 Neslab RTE-110 circulator, or equivalent, capable of maintaining the condenser cooling fluid at ~20 °C. Tap water is also acceptable.
- 4.2.2 Cole-Parmer Digi-Sense Temperature Controller, or equivalent, capable of holding 3000 mL of sample at elevated temperature when testing is performed. Two temperature controllers are used: one to control the temperature of the lubricant and the other to act as an over-temperature control.
- 4.2.3 Dual J-style thermocouple, 0.25 inch (6.35 mm) diameter, 18 inches (46 cm) long, or similar.
- 4.2.4 Suitable apparatus constructed of glass or stainless steel for safely removing 200 mL aliquots of hot oil from the heated flask.
- 4.2.5 Yamato Scientific Co., Ltd. Model LT400C (100 to 1200 rpm) laboratory stirrer, or equivalent, capable of stirring 3000 mL of sample.

5. REAGENTS AND/OR MATERIALS

- 5.1 All reagents are Reagent Grade or better. Materials available from major laboratory supply companies are acceptable.
- 5.2 Anhydrous calcium chloride.
- 5.3 Color-indicating desiccant, such as Drierite.
- 5.4 Glass wool.

6. PREPARATION OF THE APPARATUS

- 6.1 Water ingress can be a critical feature of this test. All glass-to-glass connections must be lubricated with sufficient amounts of the test oil to ensure an airtight seal.
- 6.2 All glassware and the stirrer should be cleaned according to standard practices, rinsed with distilled water or acetone, and completely dried.
- 6.3 Charge flask with 3000 mL of the test oil.
- 6.4 Put a thin film of the test oil on the flask's flange before fitting the cover to the flask. Secure the cover to the flask with the Quick Release Clamp.
- 6.5 Put a thin film of the test oil on the part of the stirrer rod that will be inside the stirrer bearing when the test is in progress. Insert the stirrer rod into the stirrer bearing. Put a thin film of the test oil on the stirrer bearing's joint and insert the assembly into the cover's center joint.
- 6.6 Put the flask and stirrer assembly in the heating mantle.
- 6.7 Put a thin film of the test oil on the condenser's male joint and insert the condenser into one of the cover's ground glass joints. Attach the condenser to the circulator using suitable flexible tubing. The flexible tubing should direct the coolant flow from the bottom of the condenser to the top of the condenser. Glindemann PTFE sealing rings can be used, if desired, for ensuring a tight seal between the joints.
- 6.8 Put a thin film of the test oil on the ground glass stopper and insert the stopper in the cover's ground glass joint.
- 6.9 Put a thin film of the test oil on the thermometer well adapter's 14/20 ground glass male joint and insert the adapter into one of the cover's ground glass joints. Insert the thermocouple in the thermometer well adapter. Attach the thermocouple to the temperature controllers. The thermocouple should be inserted so that about 2 inches (5 cm) of the thermocouple will be in the oil.