AEROSPACE MATERIAL SPECIFICATION

AMS3055™	REV. C

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Superseding AMS3055B

Petroleum Base Instrument Bearing Lubricant Viscosity 15

RATIONALE

AMS3055C has been declared "STABILIZED" by AMS Committee B. This document will no longer be updated and may no longer represent standard industry practice. This document was stabilized because it contains mature technology that is not expected to change and thus no further revisions are anticipated.

NOTE: Previously this document was reaffirmed. The last technical update of this document occurred in December 2003. Users of this document should refer to the cognizant engineering organization for disposition of any issues with reports/certifications to this specification; including exceptions listed on the certification. In many cases, the purchaser may represent a sub tier supplier and not the cognizant engineering organization.

STABILIZED NOTICE

AMS3055C has been declared “STABILIZED” by SAE AMS Committee B Finishes Processes and Fluids and will no longer be subjected to periodic reviews for currency. Users are responsible for verifying references and continued suitability of technical requirements. Newer technology may exist.

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1. SCOPE:

1.1 Form:

This specification covers the requirements for a refined paraffinic petroleum-base lubricant.

1.2 Application:

This lubricant has been used typically in spin axis bearings of gyroscopes, accelerometers, and similar bearing applications, but usage is not limited to such applications.

1.3 Safety - Hazardous Materials:

While the materials, methods, applications, and processes described or referenced in this specification may involve the use of hazardous materials, this specification does not address the hazards which may be involved in such use. It is the sole responsibility of the user to ensure familiarity with the safe and proper use of any hazardous materials and to take necessary precautionary -measures to ensure the health and safety of all personnel involved.

1.3.1 Precaution: The lubricant contains tricresyl phosphate which will cause paralysis if ingested. Do not use this lubricant in or on equipment which may contact food or other product which is taken internally.

2. APPLICABLE DOCUMENTS:

The issue of the following documents in effect on the date of the purchase order forms a part of this specification to the extent specified herein. The supplier may work to a subsequent revision of a document unless a specific document issue is specified. When the referenced document has been cancelled and no superseding document has been specified, the last published issue of that document shall apply.

2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001 or www.sae.org.

AMS 4500	Copper Sheet, Strip, and Plate, Soft Annealed
AMS 5040	Steel Sheet and Strip, 0.15 maximum Carbon, Deep Forming Grade

2.2 ASTM Publications:

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959 or www.astm.org.

ASTM D 92	Flash and Fire Points by Cleveland Open Cup
ASTM D 97	Pour Point of Petroleum Oils
ASTM D 445	Kinematic Viscosity of Transparent and Opaque Liquids (and the Calculation of Dynamic Viscosity)
ASTM D 664	Acid Number of Petroleum Products by Potentiometric Titration
ASTM D 1298	Density, Relative Density (Specific Gravity), or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method
ASTM D 1500	ASTM Color of Petroleum Products (ASTM Color Scale)
ASTM D 1552	Sulfur in Petroleum Products (High Temperature Method)
ASTM D 2266	Wear Preventive Characteristics of Lubricating Grease (Four-Ball Method)
ASTM D 2270	Calculating Viscosity Index from Kinematic Viscosity at 40 and 100 °C
ASTM D 2273	Trace Sediment in Lubricating Oils

3. TECHNICAL REQUIREMENTS:

3.1 Material:

Shall be the natural paraffinic base stock derived from Pennsylvania crude oil processed by molecular short path distillation and finished to color by filtration through a bauxite-type absorbent. Additives shall be limited to an oxidation inhibitor of the hindered bisphenol type (0.45 to 0.55% by weight) and an anti-wear agent, tricresyl phosphate (0.90 to 1.10% by weight). Only virgin material shall be used in producing this lubricant.

3.2 Properties:

The lubricant shall conform to the following requirements, determined in accordance with specified test methods, insofar as practicable:

3.2.1 Flash Point: Shall be not lower than 260 °C (500 °F), determined in accordance with ASTM D 92.

3.2.2 Pour Point: Shall be not higher than -4.0 °C (25 °F), determined in accordance with ASTM D 97.

3.2.3 Kinematic Viscosity: Shall be as follows, determined in accordance with ASTM D 445:

TABLE 1 – Kinematic Viscosity

Temperature, ± 1 °C (±2 °F)	Value, centistokes (mm^2/s)
38 °C (100 °F)	Report
100 °C (212 °F)	14.75 to 15.80

3.2.4 Gravity (API): Shall be determined in accordance with ASTM D 1298 at 15°/15 °C (59°/59 °F) and reported but shall not be limited to a specific value. Lots of lubricant submitted for acceptance testing by a previously approved manufacturer shall not vary more than ±0.006 from the gravity of the sample approved as in 4.4.1.

3.2.5 Color: Shall be not darker than ASTM 0.5, determined in accordance with ASTM D 1500.

3.2.6 Sulfur: Shall be not greater than 0.10% by weight, determined in accordance with ASTM D 1552.

3.2.7 Viscosity Index: Shall be 100 ± 5, determined in accordance with ASTM D 2270.

3.2.8 Trace Sediment: Shall be not greater than 0.025% by volume, determined in accordance with ASTM D 2273.

3.2.9 Corrosiveness and Oxidation Stability: The change in weight of an AMS 5040 steel specimen shall not exceed 0.2 mg/cm² of exposed surface and the weight change of an AMS 4500 copper specimen shall not exceed 0.6 mg/cm² of exposed surface, determined in accordance with 4.5.1.

3.2.9.1 Viscosity Change Due to Oxidation: After completion of the test of 4.5.1, viscosity of the lubricant shall be within -5 to +20% of the original viscosity, determined in accordance with ASTM D 445 at 38 °C ± 1 (100 °F ± 2).

3.2.9.2 Neutrality Change Due to Oxidation: After completion of the test of 4.5.1, the total acid or base number shall be not greater than 2.0, determined in accordance with ASTM D 664.

3.2.10 Lubricity: Wear scars shall not exceed the following values shown in Table 2, determined in accordance with 4.5.2:

TABLE 2 – Wear Scar Permissible Size

Load Kilograms	Wear Scar Average Diameter millimeter, maximum
1	0.20
10	0.30
40	0.65

3.2.11 Wetting Characteristics: The lubricant shall maintain uniform wetting of the test panel during the full period of the test, determined in accordance with 4.5.3. Minor edge effects shall be discounted.

3.2.12 Compatibility: The lubricant shall be compatible in all concentrations with each of the lubricants produced by the same manufacturer previously approved under this specification, determined in accordance with 4.5.4.

3.3 Quality:

The lubricant, as received by purchaser, shall contain only those additives expressly permitted by this specification, and shall be homogenous, free of sediment, suspended particulate matter, and undissolved water. Incorporation of additives shall be complete and removal shall not occur when the lubricant is passed through a 0.45 micron (µm) filter during application.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection:

The vendor of the lubricant shall supply all samples for vendor's tests and shall be responsible for the performance of all required tests. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the lubricant conforms to specified requirements.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Flash point (3.2.1) pour point (3.2.2) kinematic viscosity (3.2.3), viscosity index (3.2.7), and trace sediment (3.2.8) are classified as acceptance tests and shall be performed on each lot.

4.2.2 Periodic Tests: Gravity (3.2.4), color (3.2.5), sulfur (3.2.6), corrosiveness and oxidation stability (3.2.9), lubricity (3.2.10), wetting characteristics (3.2.11), and compatibility (3.2.12) are periodic tests and shall be confirmed at a frequency selected by the manufacturer.

4.2.3 Preproduction Tests: All technical requirements of this specification are classified as preproduction tests and shall be performed prior to or on the initial shipment of lubricant to a purchaser, when a change in material and/or processing requires reapproval as in 4.4.2, and when purchaser deems confirmatory testing to be required.

4.3 Sampling:

Sufficient lubricant shall be taken at random from each lot to perform all required tests. The number of determinations for each requirement shall be as specified in the applicable test procedure or, if not specified therein, not less than three.

4.3.1 A lot shall be all lubricant produced in a single production run from the same batches of raw materials under the same fixed conditions and presented for vendor's inspection at one time and shall not exceed 1000 gallons (3785 L). A lot may be packaged in smaller quantities and delivered under the basic lot approval provided lot identification is maintained.

4.3.2 When a statistical sampling plan and acceptance quality level (AQL) have been agreed upon by purchaser and vendor, sampling shall be in accordance with such plan in lieu of sampling as in 4.3 and the report of 4.6 shall state that such plan was used.

4.4 Approval:

4.4.1 Sample lubricant shall be approved by purchaser before lubricant for production use is supplied, unless such approval be waived by purchaser. Results of tests on production lubricant shall be essentially equivalent to those on the approved sample.

4.4.2 Vendor shall use ingredients, manufacturing procedures, and methods of inspection on production lubricant which are essentially the same as those used on the approved sample lubricant. If necessary to make any change in ingredients or in manufacturing procedures, vendor shall submit for reapproval a statement of the proposed changes in ingredients and/or processing and, when requested, sample lubricant. Production lubricant made by the revised procedures shall not be shipped prior to receipt of reapproval.

4.5 Test Methods:

4.5.1 Corrosiveness and Oxidation Stability:

4.5.1.1 Apparatus: Shall consist of the following:

4.5.1.1.1 Test tube of standard-wall, 50 mm ± 3 OD and 500 mm ± 10 long, with open end formed as a male ground-glass joint.

4.5.1.1.2 Allihn-type condenser with 40 mm, minimum, OD by 300 mm ± 20 long jacket, with the lower end formed as a female ground-glass joint to mate with the test tube.

4.5.1.1.3 Air tube of Pyrex with standard-wall, 6 to 8 mm OD, and length at least 50 mm longer than the combined length of the assembled test tube and condenser described in 4.5.1.1.2. The tube shall have one end drawn to an outside diameter of 0.063 inch ± 0.016 (1.60 mm ± 0.41).

4.5.1.1.4 Constant-temperature bath capable of maintaining a temperature of 150 °C ± 1 (302 °F ± 2).

4.5.1.2 Preparation of Specimens: Metal specimens (one each), nominally 0.032 inch (0.81 mm) thick by 1 inch (25 mm) square shall be cut from AMS 4500 copper and AMS 5040 carbon steel sheet or strip. Remove surface defects and burrs from both surfaces and all edges using progressively finer grades of abrasive paper. After this operation, all subsequent handling of the specimens shall be carried out with clean filter paper or tongs. Use a No. 240 (60 µm) grit, or finer, silicon carbide paper for the final sanding operation, making sure all marks produced by previous abrasive papers are removed. Clean the specimens and store separately immersed in acetone. Remove the specimens from the acetone and polish both flat surfaces and edges, using 150 mesh (100 µm) silicon carbide grains applied with an acetone moistened pad. Wipe the specimens with clean absorbent cotton pads, changing pads until the pad no longer exhibits a soil when the specimen is wiped. Wash the specimens in a warm (approximately 55 °C (131 °F)) suitable solvent and allow them to air dry. Weigh and record the weight of each specimen to an accuracy of 0.1 milligram.

4.5.1.3 Procedure: Determine the neutralization number of the lubricant sample in accordance with ASTM D 664. Determine the viscosity of the lubricant at 38 °C ± 1 (100 °F ± 2). Place the metal specimens in the test tube so that the two metal squares form a "V" in the bottom of the test tube. Weigh the test tube with metal specimens and the air tube together to the nearest 0.1 gram. Add 100 mL ± 1 of the sample lubricant to the test tube containing the metal specimens, reweigh the air tube, test tube, and contents together to the nearest 0.1 gram and determine the weight of the lubricant sample added. Assemble the test tube and condenser and mount the assembly so that 300 mm ±50 of the test tube is submerged in the constant temperature bath previously stabilized at 150 °C ± 1 (302 °F ± 2). Start the flow of cooling water through the condenser jacket. Insert the air tube, orifice end down, through the condenser and into the lubricant sample, and support it so the orifice is within 0.25 inch (6.4 mm) of the junction of the metal specimens. Connect the air tube to a supply of low-pressure, filtered, dry air and adjust the flow through the tube to 5 liters/hour ± 0.5. Continue the test for 48 - 50 hours. At the end of the test period stop the flow of air, remove the air tube, and separate the condenser from the test tube containing the specimens. Remove the test tube from the constant temperature bath, allow to cool, and wipe the outside with a cloth dampened with a suitable solvent. Reweigh the air tube, test tube, and contents to the nearest 0.1 gram, determine the weight of sample remaining, and compute the percentage of weight loss resulting from evaporation of the sample. If the weight loss exceeds 8%, the seal is inadequate and the cause of leak shall be determined and the test repeated using a new lubricant sample and fresh metal specimens. If the lubricant sample has lost less than 8% of its initial weight, proceed to remove the metal specimens using forceps. Retain the lubricant sample for additional testing and visual examination. Wash the metal specimens individually in a warm (approximately 55 °C (131 °F)) suitable solvent. Repeat the operation using fresh solvent and scrubbing the surface of the metal specimens with a stiff, short-bristled brush until the solvent shows no discoloration. Allow the squares to dry. Reweigh the metal specimens to the nearest 0.1 mg and compute the weight change for each specimen. Visually inspect the metal specimens at 20X magnification and report the presence of pitting or etching and specifically note the color of any stains visible on the surface of the copper specimen. Determine the neutralization number of the residual lubricant sample in accordance with ASTM D 664 and the viscosity at 38 °C ± 1 (100 °F ± 2) in accordance with ASTM D 445.

4.5.2 Lubricity: Shall be determined in accordance with ASTM D 2266 with the exception that the lubricant sample size shall be 10 mL ± 0.5 and the test shall be run for 60 minutes ± 1 at 600 rpm ± 20 for each load specified in 3.2.10.

4.5.3 Wettability: Clean a new glass microscope slide, 1 x 3 inches (25 x 76 mm), in chromic-sulfuric acid glass cleaner or other method which will provide a surface which is free of water breaks following the final rinse. After the cleaning operation, handle the slide with a tweezer or tongs to prevent contamination of the surface. Completely immerse the slide in the lubricant being tested. Remove the slide and place it in a fixture which will hold it in a vertical position, allowing the lubricant to drain off. Hold the slide in the vertical position for 30 to 35 minutes at room temperature. Examine slide for film discontinuity or dewetting.

4.5.4 Compatibility: Lubricant, in the volumes of 20 mL, 100 mL, and 180 mL, shall be mixed with lubricants from the same manufacturer previously approved under requirements of this specification for a total volume of 200 millilitres. These mixtures shall be prepared in 250-mL glass-stoppered flasks. The flasks shall be thoroughly agitated for 5 to 6 minutes and then stored in an oven at 100 °C ± 1 (212 °F ± 2) for 2 to 3 hours. At the end of this time, none of the mixtures shall show signs of sediment, turbidity, or crystallization. The samples shall then be stored at 38 °C ± 1 (100 °F ± 2) for an additional 2 hours or longer. None of the mixtures shall show signs of sediment, turbidity, or crystallization.

4.6 Reports:

The vendor of lubricant shall furnish with each shipment a report showing the results of tests on each lot to determine conformance to the acceptance test requirements and stating that the lubricant conforms to the other technical requirements of this specification. This report shall include the purchase order number, AMS 3055C, vendor's material designation, lot number, date of manufacture, and quantity.

4.7 Resampling and Retesting:

If any sample used in the above tests fails to meet the specified requirements, disposition of the lubricant may be based on the results of testing three additional samples for each original nonconforming sample. Failure of any retest sample to meet the specified requirements shall be cause for rejection of the lubricant represented. Results of all tests shall be reported.

5. PREPARATION FOR DELIVERY:

5.1 Packaging and Identification:

5.1.1 The lubricant shall be packaged in tightly sealed 1 quart (0.9 L) or 1 gallon (3.8 L) amber glass containers free of water or contaminants which will degrade the quality of the lubricant. Closures shall be polyethylene lined.

5.1.2 Each container of lubricant shall be identified, with not less than the following information, by an attached label using characters of such size as to be legible and which will not be obliterated by normal handling: