



AEROSPACE MATERIAL SPECIFICATION

Society of Automotive Engineers, Inc.
400 COMMONWEALTH DRIVE, WARRENDALE, PA. 15096

AMS 2570A

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PRESERVATION OF ENGINES

- PURPOSE:** To provide a procedure for preparing reciprocating aircraft engines to resist corrosion during shipment and storage.
- MATERIAL AND EQUIPMENT:** The latest revision of the following specifications and standards shall be applicable:

AMS 3070 - Oil, Corrosion-Preventive (Carburetor Slushing)
 AMS 3072 - Compound, Corrosion Preventive (Aircraft Engine)
 AMS 3075 - Compound, Corrosion Preventive (Parts and Equipment)
 AMS 3160 - Solvent, Petroleum
 AMS 3420 - Agent, Dehydrating
 AMS 3535 - Moisture Vapor Resistant Sheet
 AMS 3540 - Wrapper - Greaseproof
 AMS 3542 - Wrapper - Greaseproof Paper (Laminated)
 AMS 3610 - Plastic Film - Transparent, Moisture-Resistant
 AS 6 - Enclosure, Storage and Shipping
 AS 7 - Plug, Cylinder Dehydrator
 AS 8 - Plug, Crankcase Dehydrator
 AS 9 - Protector and Cable Attachment
 AS 10 - Indicator, Humidity - Large
 AS 11 - Equipment, Spray
 AS 160 - Collar - Propeller Shaft, Shipping
 AS 172 - Nut, Propeller Shaft, Shipping
 AS 173 - Cap, Propeller Shaft, Shipping
 AS 338 - Shipping Containers, Aircraft Engines and Components
 AS 347 - Indicator - Humidity - Medium
 ARP 197 - Preservation and Packaging of Aircraft Engine Parts

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- SLUSHING PROCEDURE:** It is recommended that the sequence of operations specified in this section be followed in all essential details and for best results should be accomplished within 48 hours, except as otherwise specified.

(a) **Crankcase Sections.**- The engine shall be securely mounted in its normal running position. In this position the engine shall be driven from an external source of power or operated under its own power at a crankshaft speed of not less than 500 rpm. While running at this speed the engine lubricating system shall feed from a reservoir of preservative oil, AMS 3072. During this operation the oil shall be maintained within the temperature limits of 215-260°F. If because of peculiarities of individual installations it may not be practical to retain the temperature at or above the low limit without exceeding the high limit, then the high limit (260°F) shall be the controlling temperature. The engine shall be operated for a minimum 15 minutes under the above conditions.

(b) **Cylinder Bores.**- The above procedure shall be supplemented by spraying the cylinder bores with preservative oil, AMS 3072, by one of the following methods:

- (1) Aspirating.- Within the last two minutes of the above specified slushing run, while the engine is turning over, the preservative oil, AMS 3072, under pressure, shall be aspirated through the induction system. The quantity of compound to be used to insure adequate coverage, and the procedure, should be determined for each individual engine model. The engine shall be shut down immediately after this operation.
- (2) Gun Spraying.- As an alternate procedure the cylinder bores may be preserved by the following procedure. At the end of the engine run using the preservative oil as a lubricant, the fuel supply shall be cut off and the engine speed accelerated at the time the ignition is switched off. Within two hours from the shut down time each cylinder of the engine shall be sprayed with preservative oil, AMS 3072, through a spark plug hole with the piston at the bottom of stroke. This operation may be done on cylinders in firing order. Twenty-five millileters of oil is considered adequate for each cylinder provided application is conducted in a manner to ensure complete coverage (See AS 11 for recommended equipment.)
- (c) Oil and Coolant Drainage.- Preferably while the engine is still warm from the procedure specified in paragraph 3(a) excess oil shall be drained from the engine crankcase, filter or screen chambers, and/or sump(s). Screens or filters shall be removed, cleaned, slushed with preservative oil, AMS 3072, and replaced. The coolant shall be drained from liquid cooled engines and the coolant chambers dried. All drain plugs shall be replaced and safetied.
- (d) Cam and Rocker Boxes.- Within three hours after the procedure specified in paragraph 3(a), all valve mechanism such as cam shafts, rockers, springs, washers, valve stems and interior of housings and rocker boxes shall be thoroughly coated with preservative oil, AMS 3072. This preservative oil shall be applied preferably by spraying using pressure gun equipment. Covers which have been removed to accomplish this operation shall be cleaned and reinstalled.
- (e) Exhaust Ports.- The exhaust ports shall be sprayed directly with preservative oil, AMS 3072, so as to coat thoroughly the opened exhaust valves as well as the port walls. Seal the exhaust ports with oil and moisture-resistant covers or gasketed plates. Where an exhaust manifold is supplied on the engine prior to shipment see instructions contained in paragraph 4(d).
- (f) Accessory Drives.- The ends of accessory drives for which oil seals are provided shall be thoroughly coated with preservative oil, AMS 3072. Covers or cover plates with gaskets shall be installed over all accessory drives.
- (g) Cylinder Bore Preservation.- Before the engine has been prepared for final packing the cylinders shall be sprayed again in the manner described in paragraph 3(b)(2). The propeller shaft shall then be turned at least six revolutions and the cylinders resprayed without moving the pistons. The cylinders shall then be thoroughly drained of excess compound through the spark plug holes. Sufficient time shall elapse for sufficient draining to ensure against the danger of subsequent hydraulic damage to cylinders and moving parts. The use of a suction gun to facilitate removal of this drained compound is recommended. After this operation a temporary tag shall be tied to the propeller shaft with the warning note "DO NOT TURN PROPELLER SHAFT".
- (h) Cleaning.- Where necessary the external surfaces of the engine may be cleaned with petroleum solvent, AMS 3160 or equivalent.

4. DEHYDRATING PROCEDURE: (a) Cylinder Dehydrators.- Cylinder dehydrator plugs, conforming to AS 7, shall be installed in each spark plug opening and tightened to the torque recommended in AS 7 for the applicable plug size. The moisture seal shall not be removed from the end of the dehydrator plug until immediately before the plug is installed.

(b) Crankcase Dehydrators.- All openings to the interior of the engine such as breathers and oil connectors shall be plugged or suitably sealed with oil and moisture resistant closures. The oil sump plug or closure(s) of other selected opening(s) shall be removed and replaced with a crankcase dehydrator plug of suitable size. The dehydrator plug shall be tightened to the torque specified for applicable plug size listed in AS 8. The removed plugs and/or closures shall be attached to engine together with suitable instructions for removing dehydrator and reinstalling permanent plugs or covers. The quantity of crankcase dehydrators shall be installed according to the following schedule:

<u>Engine Weight</u> <u>Pounds</u>	<u>Weight of Desiccant</u> <u>Grams Minimum</u>	<u>Minimum No. of Plugs</u> <u>AS 8</u>
Up to 500	20	1
500 to 1000	40	1 or 2
1000+ to 2000	40	2
2000+ to 3000	60	2
3000+ to 4000	80	3

The moisture seals shall not be removed from the ends of dehydrators until immediately before plugs are installed.

(c) Induction Port Dehydrators.- Dehydrating agent, contained in a sift-proof bag, as specified by AMS 3420 shall be installed at the entrance to the air induction system to the engine according to the following schedule:

<u>Cylinder Displacement per Engine</u> <u>Cubic Inches</u>	<u>Desiccant Quantity, AMS 3420 - Grade E</u> <u>Ounces Minimum</u>
Up to 1000	4 oz.
1000+ to 2000	8 oz.
2000+ to 3000	12 oz.
3000+ to 4000	16 oz.
4000+	16 oz. + 4 oz./1000 cu. in. or fraction thereof.

The above quantities may be interpolated to more exact amounts for actual "cylinder displacement". Where openings in small engines are not of sufficient size to accommodate the above specified amounts of desiccant a bag of dehydrating agent as large as practicable shall be used. Where the carburetor is shipped installed in its operating location the desiccant shall be placed at the induction entrance of the carburetor. A conspicuous warning tag or notice shall be provided to indicate presence of the dehydrating agent and need for removal prior to engine operation. Handling of the desiccant shall be held to a minimum and shall always be installed in the engine immediately after removal from its closed shipping container. The intake manifold or carburetor opening shall then be immediately sealed with a gasketed cover or plate securely fastened in place. It is desirable to have the bags containing dehydrating agent installed in such a manner that they will be removed with the cover or observed when cover is removed.

(d) Exhaust Manifold.- When an exhaust manifold is shipped attached to the engine, a one-half pound bag of dehydrating agent, AMS 3420, Grade E, shall be installed in the opening(s) of the collector ring or rings and the opening(s) closed with an oil and moisture resistant diaphragm(s) or sealing cover(s). A conspicuous warning tag indicating the presence of the dehydrating material shall be fastened adjacent to the opening. The dehydrating agent shall be installed directly from its closed shipping container.

(e) Propeller Shaft Breather.- Where a propeller shaft breather is provided with sufficient space a one-quarter pound bag of dehydrating agent, AMS 3420, Grade E, shall be located inside the propeller shaft thread protector cap with provision for its removal with the cap. The bag of dehydrating agent shall not be removed from its closed shipping container until immediately before installation.

5. PACKING PROCEDURE: All ends of locking wire shall be bent inward or covered with tape to prevent rupture of engine envelope. All loose ends of pipes, ignition leads, etc., shall be secured in place to prevent chafing of engine envelope. The spark plug leads may be supported in shipment by fastening the terminal protector, AS 9, to the end of each cylinder dehydrator plug. Remove warning tag from end of propeller shaft having warning note "DO NOT TURN PROPELLER SHAFT".

(a) Engine Envelope.- An envelope incorporating, in general, the requirements of AS 6 shall be fitted to the shipping case saddle, anchor plate or to the engine, whichever is more convenient. Holes for the anchor belts shall be punched and the belts inserted to hold envelope in position. The shipping case saddle or anchor plate together with envelope shall then be fitted to the engine taking care not to tear the envelope. The engine and envelope with attaching components shall be then secured to the shipping container. This procedure may be varied at the discretion of the shipper, provided the anchor plate or saddle is removable with the engine.

(b) Shipping Container.- The engine shipping container shall conform to the requirements of AS 338 where applicable.

(c) Dehydrating Agent.- Bags of dehydrating agent, AMS 3420, Grade E, shall be uniformly distributed around the engine at the rate of one pound per cylinder for engines up to and including 14 cylinders. For engines with more than 14 cylinders the recommended minimum of 14 pounds shall be supplemented by the addition of dehydrating agent at the rate of at least one pound per each additional two cylinders. Not less than a half pound per pound weight of paper, etc., shall be added to provide for dehydration of the dunnage within the shipping envelope. The dehydrator bags shall not be removed from closed shipping container until immediately before attachment to the engine.

(d) Humidity Indicator.- A humidity indicator, AS 10 or AS 347, shall be secured to the engine opposite the inspection port in the shipping container in a manner to be readily observed from outside the encased engine by lifting the inspection port cover.

(e) Creped paper, canvas, or other suitable covering shall be placed around the periphery of radial engines and other locations as required to prevent damage to the shipping envelope which might result from chafing on projections. For in-line engines the covering shall be placed so as to provide maximum protection.

(f) Propeller Shaft.- Exterior surfaces of the propeller shaft shall be coated thoroughly with preservative oil, AMS 3072, or preservative compound AMS 3075. A thread protector cap, AS 173, shall be installed, and the splines covered with greaseproof paper, AMS 3540 or AMS 3542. Any surface of the propeller shaft exterior to the engine envelope must be coated with preservative compound, AMS 3075.

(g) Propeller Shaft.- (Alternate Method) When it is contemplated that the engine will be handled while in storage with the aid of a lifting eye applied to the end of the propeller shaft a hole shall be carefully cut to the inside diameter of the large gaskets provided near the open end of the shipping envelope. Shipping parts AS 160, AS 172, and AS 173 shall be applied in proper sequence as explained in AS 6. The propeller shaft splines shall be coated and wrapped as detailed in paragraph 5(f). With this arrangement for shipping an additional band of greaseproof paper, AMS 3540 or AMS 3542 shall be applied to the cone seat and shall be of sufficient width to extend to the top of the gasket area. This will provide insulation from contact corrosion between the envelope material and the propeller shaft. The threads, cone seat, and inside of the propeller shaft shall be thoroughly coated with corrosion-preventive compound, AMS 3075, before shipping parts are installed. A second application of corrosion-preventive compound to the threads after installation of nut and before installation of thread protector cap is recommended.

(h) Envelope Sealing.- The engine shipping envelope shall be heat sealed (using a temperature within the range specified on the envelope identification panel) as soon as practicable after attaching dehydrator bags as specified in paragraph 5(c). In so doing, the envelope shall be unfolded and the open edges brought together and sealed under heat and pressure so as to provide a continuous moisture-proof seam. Excess air within the envelope shall be removed by the use of a suitable exhaust fan to assist in folding the envelope around the engine, but not to an extent which will cause damage to the envelope.

(i) After the sealing operation the excess material of the envelope shall be folded around the engine and secured with tape in a manner to provide a minimum size package. The envelope should be so arranged as to permit unobstructed visibility of the humidity indicator.

(j) Closure of Shipping Container.- The engine container sides and/or cover shall be assembled over the envelope enclosed engine in such a manner as not to rupture the envelope. The humidity indicator contained within shall be carefully examined through inspection port in the side of the container for suitable alignment and visibility. The inspection port cover shall be closed and sealed and the container secured for shipment.

(k) Marking.- In addition to dispatching information which may be special for each consignment the shipping container shall be marked as specified in AS 338.

6. ACCESSORIES: Preservative oil, AMS 3072, may be used for the preservation of accessories except carburetors, and other units which contain elements such as synthetic rubber diaphragms which may be damaged by this compound. Unless the recommendations of the accessories manufacturers are otherwise, these "excepted" accessories shall be preserved with oil conforming to AMS 3070.