AERONAUTICAL MATERIAL SPECIFICATION

Society of Automotive Engineers, Inc.
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AMS 3420B

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DEHYDRATING AGENT
Silica Gel

1. ACKNOWLEDGMENT: A vendor shall mention this specification number and its revision letter in all quotations and when acknowledging purchase orders.

2. FORM: The form shall be granular and in suitable particle sizes as required. If desired, it shall be impregnated with cobalt chloride for the purpose of indicating the relative humidity of the ambient atmosphere.

3. GRADES:

Grade D - Through #6 - On #18 Sieve, Indicator Type.
Grade E - - On #80 Sieve, Plain Type.
Grade F - - On #80 Sieve, Indicator Type.

Any combination of the above types may be blended together in proportions as specified by the purchaser, provided the quantity of the indicating types constituting the blend shall be not less than 25% of the whole.

4. COMPOSITION: (a) Grade E shall be silica gel containing not less than 99.4% silica (SiO_2) on a dry basis.

(b) Grades D and F shall be silica gel (99.6% minimum SiO_2) impregnated with a maximum of 1.5 pounds of anhydrous cobalt chloride ($CoCl_2$) per 100 pounds of finished material on a dry weight basis. These grades shall have characteristic colors when in equilibrium with atmospheres of varying relative humidities and shall match the colors shown on color chart Aeronautical Standard, AS 167, for the specified humidities of 0, 20, 40 and 60 per cent at 75°F ± 5 (24°C ± 3).

5. REQUIREMENTS: The material as shipped shall meet the following detailed requirements:

(a) The material shall be non-deliquescent.
(b) The material shall adsorb water by physical means alone except for the effect of the cobalt chloride used for impregnation.
(c) The water content of the activated material shall not exceed the following:

Grade	Water Content % by Weight
D and F	5.75
E	No Limit

(d) Water vapor adsorption capacities of the respective grades of material when in equilibrium with the relative humidities indicated, and as determined by the test procedure described in paragraph 6(b), shall be not less than the following:

Relative Humidity %	Water Vapor Adsorption % by Weight Grades D & F	Grade E
10	4.3	5.7
20	8.6	10.5
40	18.2	21.5
60	27.7	28.0
80	32.9	31.2

(e) Sieve analyses of the respective grades of material, after 150 gram samples have been shaken for 3 minutes in a sieve shaker equivalent to the W. S. Tyler Ro-Tap machine, shall be as follows: the sieve numbers refer to U. S. Standard sieves.

	Grade D % by Weight	Grades E & F % by Weight
Through 0.265" opening retained on #6	2.0 max	
Through #6, retained on #12	55.0 min	
Through #12, retained on #18	19.0 min	
Through #18	3.5 max	
Through #20	0.5 max	
Retained on 0.530" opening		0.0
Through 0.530" opening retained on #80		96.0 min
Through #80		4.0 max

(f) Particle strength of the respective grades of material, as determined by the test procedure described in paragraph 6(a), shall be as follows:

	Grade D % by Weight	Grades E & F % by Weight
Through #30 sieve	1.50 max	---
Through #200	---	0.8 max

6. TEST PROCEDURES: (a) Particle Strength Test.- Except as specifically described below for the different grades of material the equipment used and performance of test shall be as follows:

The material to be tested shall first be subjected to the particle size analysis as described in paragraph 5(e). Material to be used for this test shall be selected for size in accordance with the schedule tabulated below showing U. S. Standard Sieve Sizes. A representative sample of 50 ± 5g weighed to an accuracy of ± 0.2g shall be placed on the standard sieve size, either #18 or #80 depending on the grade of material, together with five copper discs, each equivalent in weight and size to a U. S. one cent piece.

For Grade D	For Grades E & F
Retained on #18 and coarser sieves	Retained on #80 sieve

The sieve prepared as above shall be fitted with a tight cover and nested with a finer sieve and a retaining pan. The finer sieve size used shall be in accordance with the following schedule:

For Grade D	For Grades E & F
#30 sieve	#200 sieve

This sieve and pan assembly shall be fitted within the framework of a standard W. S. Tyler Ro-tap Testing Sieve Shaker (or equivalent) directly connected to a motor running at 1725 rpm. This equipment shall be operated for 15 minutes.

After the shaking operation the residue material collected in the retaining pan shall be weighed and reported as per cent of original weight of sample passed through either the #30 or #200 sieve as related to the grade of material being tested.

The weighing equipment used for the above purpose shall be accurate within 0.1g. If the sum of weights of the material in the sieve and pan assembly after the shaking operation is less than 95% or more than 105% of the original sample weight the test shall be repeated beginning with the particle size analysis. Excess weight, after screening, is usually from water adsorption and is best avoided by bringing the sample, before the test, approximately to equilibrium with the atmosphere of the room in which the test will be conducted.

(b) Water Vapor Adsorption Capacity.-

(1) Apparatus and Operation.- Six glass saturator bottles, of at least 500 ml. capacity and with petticoat bubblers, shall be arranged as in Figure 1. Air from a flowmeter, capable of measuring 3 - 5 liters of air per minute, is passed through the saturator bottles, which shall contain one-third to one-half their volume of a solution of sulphuric acid of a concentration required to give the desired relative humidity (see table below). The air from the saturator bottles shall be passed through a mist trap, which can be an ordinary drying tube or cylinder, approximately 1.5" in diameter, eight to nine inches high packed with glass wool. The air then shall be passed through the adsorption bulb, which can be a cylindrical bulb with a flat bottom and a short tubular arm and a ground glass top with a tubular opening for the air to pass. (See Figure 2 for acceptable equipment.)

Similar sets of this apparatus shall be used to make determinations simultaneously for relative humidities of 10, 20, 40, 60 and 80 per cent at room temperature 77 - 86°F (25 - 30°C). Any temperature change during a test shall be less than ± 2°F.

Relative Humidity Solutions

Solution	Per Cent by Weight	Per Cent Relative Humidity at 77-86°F
H_2SO_4	64.7	10
H_2SO_4	58.2	20
H_2SO_4	47.8	40
H_2SO_4	38.4	60
H_2SO_4	26.4	80

(2) Procedure.- Weigh 5-10 grams of gel, weighed to the nearest milligram, into a tared adsorption bulb. The material shall not be exposed to the air any more than is necessary for handling. After making a tight rubber connection to the exit arm of the mist trap, adjust the air pressure control to give the desired 4 ± 0.5 liters per minute. After three hours, weigh the adsorption bulb quickly and repeat the weighings until two successive weighings, approximately one hour apart, show a weight variation not exceeding 10 milligrams. Generally the sample weight increase will reach a maximum and then decrease slightly before it reaches constant weight. The gain in weight divided by the original weight of the material, multiplied by 100, will give the percentage by weight of water vapor that the material will hold in equilibrium with air of relative humidity attained in the saturators. The attained relative humidity in the saturators shall be determined on the exit end solutions after the gel has come to equilibrium.

(c) Water content.-

Procedure.- Weigh accurately 2-4 grams of gel into a silica crucible, cover and immediately place into cool electric furnace. Within one hour bring the temperature to bright red heat, about 1760°F (960°C). Remove the cover lid from crucible and continue to heat crucible for 1/2 to 3/4 hour. Remove crucible from furnace and place in a desiccator for 1/2 hour to cool before weighing.

Calculate water content as follows:

$$\frac{\text{Loss in Weight}}{\text{Original weight of sample}} \times 100 = \% \text{ water content.}$$

7. PACKAGING: (a) Grade D and Grade F shall be furnished in bulk unless otherwise specified.

(b) Grade E shall be furnished in 5 gram, 10 gram, 15 gram, 1 ounce, 2 ounce, 4 ounce, 8 ounce, 16 ounce, and 5 pound bags unless otherwise specified. The bags shall be substantially dust-proof, which shall be accomplished by means of a paper lining or other suitable means which will not materially retard the rate of adsorption of water vapor by the contained dehydrating agent.

8. PACKING: (a) Domestic Shipments.- Unless otherwise specified, all types of the dehydrating agent shall be packed in 5 pound, 25 pound or 100 pound metal containers.

(1) Five pounds or less shall be packed in one-gallon round cans made from chemically treated steel or blackplate, coated on the inside and outside with a baked-on enamel, top fitted with multiple-friction opening and plug, top and bottom double seamed and cemented, side seams cemented, body and bottom made from 31 U. S. standard gauge plate, top ring and plug made from 30 U. S. standard gauge plate, or; alternately, in one-gallon cans made from special coated manufacturer's terneplate, top-fitted with multiple-friction opening and plug, top and bottom double seamed and cemented, side, seams soldered, body and bottom made from 95 pounds basis weight terneplate, top ring and plug made from 100 pounds basis weight terneplate.

(2) Twenty-five pounds or less shall be packed in five-gallon square cans made from chemically treated steel or blackplate, coated on the inside and outside with a baked-on enamel, top fitted with multiple-friction opening and plug, top and bottom double seamed and cemented, side seams cemented, entire can made from 30 U. S. standard gauge plate or; alternately, in five-gallon square cans made from 107 pounds basis weight special coated manufacturer's terneplate, all seams soldered, top fitted with multiple friction opening and plug.

(3) Both the one-gallon round cans and the five-gallon square cans shall be packed in commercial containers so constructed as to insure acceptance by common or other carrier for safe transportation at the lowest rate to the point of delivery. Each container shall comply with the requirements of the Consolidated Freight Classification Rule in effect at the time of shipment and shall be able to withstand storage, rehandling, and reshipment without the necessity of repacking.

(4) One-hundred pound (nominal size) metal containers shall be bolted ring style and straight sided type with welded side seam, full open head, closure fitted with rubber gasket. The body and heads of containers shall be at least 24 U. S. standard gauge low carbon sheet steel, suitably treated to prevent corrosion. No overpacking is required.

(5) Random samples, closed as for use, shall withstand the following test without leakage or other evidence of failure. The drum filled with finely divided material to the authorized gross weight shall be dropped from a height of four feet on to solid concrete so as to strike diagonally on top chime. Closing devices and other parts projecting beyond chime or rolling hoops shall withstand this test. Leaks and other defects may be repaired only by the same welding method used in constructing the container.

(b) Overseas Shipments.- Unless otherwise specified, all grades of dehydrating agent shall be packed in 25 pound or 100 pound metal containers.

(1) Twenty-five pounds or less of material shall be packed in a five-gallon lug cover style container with welded side seam, closure fitted with rubber gasket. The body and heads of containers shall be at least 24 U. S. standard gauge low carbon sheet steel suitably treated to prevent corrosion. No overpacking is required.

(2) One-hundred pound (nominal size) metal containers shall be bolted ring style and straight sided type with welded side seam, full open head, closure fitted with rubber gasket. The body and heads of containers shall be at least 22 U. S. standard gauge low carbon sheet steel suitably treated to prevent corrosion. No overpacking is required.

(3) Both small and large capacity export containers shall withstand the test specified in paragraph 8(a)(5).

9. MARKING: The following marking shall be conspicuous on each shipping container of dehydrating agent:

DEHYDRATING AGENT
Specification AMS 3420B
Grade _____
Net Weight _____ lb.
Gross Weight _____ lb. _____ oz.
Manufacturer's Name or Trade Mark
Purchase Order Number _____
Date of Shipment _____

The following precautionary label shall be placed in a conspicuous location on each container:

C A U T I O N

Inspect by Weight - Not by Count
gross weight as packed
_____ lbs. _____ oz.

This Container Contains
Dehydrating
Agent

Due to the moisture adsorbent properties of the dehydrating agent, this container positively must not be opened for any longer period than is absolutely necessary for withdrawals. Withdrawals should be as near as possible to the exact quantity intended to be used.

The container shall be tightly resealed immediately after any withdrawals.

Other markings pertaining to container as required by I. C. C. regulation.

10. REPORTS: If specified, the manufacturer shall supply three copies of a notarized report of the composition and the quantitative results of tests on the batch of material from which the order was filled. This report shall include the purchase order number, material specification number, net quantity, and date of shipment.

11. APPROVAL: (a) A manufacturer shall supply samples for approval when requested by the purchaser.

(b) For purposes of sampling, where requested by the purchaser, each shipment shall be apportioned by the vendor into lots of 5000 pounds each (any final fraction of less than 5000 pounds shall be considered one lot). Three one-pound samples of each lot shall be composited from representative samples taken from ten per cent (10%) of the shipping containers comprising each lot. The three one-pound samples shall be used as follows:

(1) One for the purchaser.
(2) One for the vendor.
(3) One to be held by the purchaser for 90 days to be used for referee tests in case of dispute.

12. REJECTIONS: Material not conforming to this specification or to authorized modifications shall be subject to rejection. Unless otherwise stipulated, rejected material will be returned to vendor at vendor's expense, unless purchaser receives, within three weeks of notification of rejection, other instructions for disposition.

NOTE. SIMILAR SPECIFICATION: This AMS meets the minimum requirements of AN-D-6c, Amendment 1, dated 22 January, 1945, in the following types and corresponding grades:

AN-D-6c	AMS 3420B
Type IV	Grade D
Type V	Grade E