AERONAUTICAL MATERIAL SPECIFICATION

Society of Automotive Engineers, Inc.
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D E H Y D R A T I N G A G E N T
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 degree of saturation.

3. GRADES:

Grade D -	Through #6 -	On #18 sieve, Indicator Type
Grade E -		On #45 sieve, Plain Type
Grade F		On #45 sieve, Indicator Type

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

4. COMPOSITION:

a. Grade E shall be silica gel containing not less than 99.6% silica (SiO_2) on a dry basis.

b. Grade 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 dryweight 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 $77^{o}F \pm 5$ ($25^{o}C \pm 2.8$).

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

a. The material shall be non-deliquescent.

b. The material shall adsorb moisture 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
E	6.00
D & F	5.75

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 6b., shall be not less than the following:

Relative Humidity %	Water Vapor Adsorption Grade E % by weight	Grades D & F % by weight
10	5.75	4.25
20	11.00	8.25
40	21.75	18.25
60	28.00	27.50
80	31.25	32.75
100	33.50	34.00

e. Sieve Analyses of the respective grades of material, after 150 gram samples have been shaken for exactly 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 inch 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 1.060 inch opening		0.0
Through 1.060 inch opening, retained on #45		96.0 min
Through #45		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	2.0 max	------
Through #200 sieve	-------	0.8 max

6. TEST PROCEDURES:

a. Particle Strength Test.-

(1) For Grade D Only.-

(a) The material to be tested shall first be subjected to the particle size analysis as described in paragraph 5d. Material retained on the #18 and coarser sieves shall be used for particle strength test. Mix thoroughly and weigh a representative 50 ±5 g. sample to within ±0.2 g. This sample together with five copper discs, each equivalent in weight and size to a U. S. penny shall be placed on a #18 sieve, eight inches in diameter.

(b) This sieve shall be fitted with a tight cover and nested with a #30 sieve and pan. This 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 with a speed of 1725 revolutions per minute, and the machine operated for 15 minutes.

(c) After the shaking operation the material in the retaining pan shall be weighed and the weight of this fraction referred to the total weight of the recovered material to obtain the calculated figure termed "Per Cent Thru #30 Sieve" in paragraph 5e. The weighing equipment to be used for the above purpose should be accurate to within 0.1 g. The test made must be repeated beginning with the particle size analysis if the sum of the weights of the material in the sieve and pan assembly after the shaking operation is less than 95% or more than 105% of the actual weight of the original sample used in the particle strength test. Excess weight, after any screening operation, is usually due to water adsorption and is best avoided by bringing the sample to approximate equilibrium with the atmosphere of the room before starting the test.

(2) For Grades E and F Only.-

(a) The material to be tested shall first be subjected to the particle size analysis as described in paragraph 5d. Material retained on the #45 sieve shall be used for particle strength test. A representative 50 ± 5 g. sample shall be weighed to within ±0.2 g. This sample together with five copper discs, each equivalent in weight and size to a U. S. penny. shall be placed on a #45 sieve, eight inches in diameter.

(b) This sieve shall be fitted with a tight cover and nested with a #200 sieve, and a retaining pan. This 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 with a speed of 1725 revolutions per minute and the machine operated for 15 minutes.

(c) After the shaking operation the material in the retaining pan shall be weighed and the weight of this fraction referred to the total weight of the recovered material to obtain the calculated figure termed "Per Cent Thru #200 Sieve" in paragraph 5e. The weighing equipment to be used for the above purpose should be accurate to within 0.1 g. The test made must be repeated beginning with the particle size analysis if the sum of the weights of the material in the sieve and pan assembly after the shaking operation is less than 95% or more than 105% of the actual weight of the original sample used for the particle strength test. Excess weight, after any screening operation, is usually due to water adsorption and is best avoided by bringing the sample to approximate equilibrium with the atmosphere of the room before starting the test.

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 per Fig. 1. Air from a flowmeter, capable of measuring 3 - 5 liters of air per minute, is passed thru 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 thru 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 thru 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, 80, and 100 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
H_2O	100.0	100

(2) Procedure.- Weight 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.-

(1) 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 shall be furnished in bulk unless otherwise specified.

b. Grades E and F shall be furnished in 5 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 grades shall be packed in 25-pound, or 100-pound metal containers.

(1) Twenty-five pounds or less, shall be packed in five-gallon square cans made from chemically treated steel or black plate, 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 doped, side seams doped, entire can made from 30 gauge plate or; alternately, in five-gallon cans made from 107 pounds basis weight special coated manufacturers terneplate, all seams soldered, top fitted with multiple friction opening and plug.

The five gallon 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 Rules in effect at the time of shipment and shall be able to withstand storage, rehandling, and reshipment without the necessity of repacking.

(2) One-hundred-pound (nominal size) metal containers shall be of the bolted ring style with welded side seam, full open head, closure fitted with rubber gasket, and shall comply with the requirements of ICC Specification 37-E. No overpacking is required.

b. Overseas Shipments.- Unless otherwise specified, all types 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, and complying with the requirements of ICC Specification 37-D. No overpacking is required.

(2) One-hundred-pound (nominal size) metal containers shall be of the bolted ring style with welded side seam, full open head, closure fitted with rubber gasket and shall comply with the requirements of ICC Specification 37-D. No overpacking is required.

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

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

10. REPORTS: Unless otherwise 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:

a. Failure of the material to conform to any one of the requirements of this specification shall be cause for rejection of the material which fails to comply. If, in the opinion of the vendor, the failure was due to faulty test methods, the test may be repeated on the vendor's retained sample.

b. In case of inconsistencies of results, the test shall be repeated on the purchaser's retained sample. Failure of any two of the three samples to meet the requirements shall be cause for final rejection of the lots represented. Material which has been rejected may be reworked to correct the defects and resubmitted for acceptance. Before resubmitting, full particulars concerning the previous rejection and the action taken to correct the defects found in the original shall be furnished the purchaser. A vendor shall pay all transportation charges on rejected material.

NOTE. SIMILAR SPECIFICATION: Army-Navy Aeronautical AN-D-6 is listed for information only and shall not be construed as an acceptable alternate unless all requirements of this AMS are met.