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SUPERSEDING
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17 May 1966
(See 6.7)

MILITARY SPECIFICATION

DESICCANTS, ACTIVATED, BAGGED, PACKAGING USE AND STATIC DEHUMIDIFICATION

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers bagged, chemically inert, dehydrating agents that prevent corrosion and mildew by adsorbing the moisture from the air of an enclosed space.

1.2 Classification. The bagged desiccant shall be furnished in the following types, as specified (see 6.2):

Type I - General purpose.
Type II - Non-dusting.
Type III - For specific conditions (8 and 16 units only).

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications and standards. The following specifications and standards form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of these documents shall be those listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS) and the supplement thereto, cited in the solicitation.

SPECIFICATIONS

FEDERAL

QQ-A-250/4 - Aluminum Alloy 2024, Plate and Sheet.
QQ-B-637 - Brass, Naval: Rod, Wire, Shapes, Forgings, and Flat Products with Finished Edges (Bar, Flat Wire, and Strip).

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Naval Sea Systems Command, SEA 55Z3, Department of the Navy, Washington, DC 20362-5101 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

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FEDERAL (Continued)

QQ-M-44 - Magnesium Alloy Plate and Sheet (AZ31B).
RR-S-366 - Sieve Test.
TT-E-485 - Enamel, Semigloss, Rust-Inhibiting.
PPP-C-96 - Cans, Metal, 28 Gage and Lighter.
PPP-D-723 - Drums, Fiber.
PPP-P-704 - Pails, Metal: (Shipping, Steel 1 through 12 Gallons).

MILITARY

MIL-P-116 - Preservation, Methods of.
MIL-I-8835 - Indicator, Humidity, Card, Chemically Impregnated.

STANDARDS

MILITARY

MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes.
MIL-STD-129 - Marking for Shipment and Storage.
MIL-STD-147 - Palletized Unit Loads.
MS26507 - Indicator Card, Desiccant Relative Humidity (8% ± 5%)
MS27684 - Drum, Metal-Shipping and Storage 3 to 12 Gallons.

2.1.2 Other Government publication. The following other Government publication forms a part of this specification to the extent specified herein. Unless otherwise specified, the issues shall be those in effect on the date of the solicitation.

DEPARTMENT OF TRANSPORTATION (DOT)

Specification 37A - Steel Drums. Single-Trip Container. Removable Head Required.

(Application for copies should be addressed to the Superintendent of Documents, Government Printing Office, Washington, DC 20402.)

(Copies of specifications, standards, and publications required by contractors in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting activity.)

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted shall be those listed in the issue of the DoDISS specified in the solicitation. Unless otherwise specified, the issues of documents not listed in the DoDISS shall be the issue of the nongovernment documents which is current on the date of the solicitation.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

A 569 - Standard Specification for Steel, Sheet and Strip, Carbon (0.15 Maximum Percent), Hot-Rolled, Commercial Quality. (DoD adopted)

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.)

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UNIFORM CLASSIFICATION COMMITTEE AGENT
Uniform Freight Classification Ratings, Rules and Regulations

(Application for copies should be addressed to the Uniform Classification Committee Agent, Tariff Publication Officer, Room 1106, 222 South Riverside Plaza, Chicago, IL 60606.)

NATIONAL MOTOR FREIGHT TRAFFIC ASSOCIATION, INC., AGENT
National Motor Freight Classification

(Application for copies should be addressed to the National Motor Freight Traffic Association, Inc., ATA TRAFFIC Dept., 2200 Mill Road, Alexandria, VA 22314.)

(Nongovernment standards and other publications are normally available from the organizations which prepare or which distribute the documents. These documents also may be available in or through libraries or other informational services.)

2.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein (except for associated detail specifications, specification sheets or MS standards), the text of this specification shall take precedence. Nothing in this specification, however, shall supersede applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Qualification. Bagged desiccant furnished under this specification shall be products which are authorized by the qualifying activity for listing on the applicable qualified products list at the time set for opening of bids (see 4.2 and 6.3).

3.2 Material.

3.2.1 Desiccant. The desiccant shall be newly manufactured and shall be nondeliquescent.

3.3 Definition of desiccant unit. Desiccant will be purchased on the basis of adsorption capacity. A desiccant unit is that quantity of desiccant, as received, which will adsorb at equilibrium with air at 25 degrees Celsius (°C) at least the following quantities of water vapor:

(a) 3.00 grams at 20 percent relative humidity (R.H.), and
(b) 6.00 grams at 40 percent R.H.

3.4 Unit weight. The weight of desiccant constituting a desiccant unit is defined as the unit weight. Unit weight shall not exceed 50.0 grams. Unit weight shall be specified by the manufacturer when submitting qualification samples (see 4.2.1), and shall be verified by the qualifying laboratory using the methods specified in 4.6.1. The unit weight thus approved shall be used in all subsequent inspections.

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3.4.1 Unit adsorption capacity (equilibrium conditions). The actual weight of water vapor adsorbed by a unit weight of desiccant in equilibrium with air at 25°C, when tested as specified in 4.6.1, is defined as the unit adsorption capacity.

3.4.1.1 In qualification tests, unit adsorption capacity shall be at least:

(a) 3.00 grams at 20 percent R.H., and
(b) 6.00 grams at 40 percent R.H.

3.4.1.2 When testing a bagged desiccant, an allowance shall be made for normal manufacturing variations. In connection with such inspection testing, unit adsorption capacity shall be at least:

(a) 2.85 grams at 20 percent R.H., and
(b) 5.70 grams at 40 percent R.H.

3.5 Unit volume. The volume of desiccant constituting a desiccant unit is defined as the unit volume. Unit volume shall be not greater than 45.0 milliliters (mL) when tested as specified in 4.6.2.

3.6 Unit content per bag. The number of desiccant units contained in each bag (unit content) shall be clearly marked on the bag label. When tested as specified in 4.6.10, bags of desiccant shall actually contain at least 95 percent of the number of units indicated on the bag label.

3.7 Unit adsorption rate. When tested as specified in 4.6.4, the bagged desiccant, as received, shall adsorb in 7 hours the weight of water vapor in accordance with table I.

TABLE I. Unit adsorption rate requirements.

Bag size, units	At 40 percent R.H. (gram) minimum	At 80 percent R.H. (gram) minimum
16 and smaller sizes	0.25	0.70

3.8 Humidity control. A unit of desiccant shall prevent a closed metal box from exceeding 60 percent R.H., when tested as specified in 4.6.3.

3.9 Adsorption capacity and rate after reactivation. After the reactivations and tests specified in 4.6.5, bagged desiccant shall retain at least 90 percent of the original unit adsorption capacity, and at least 80 percent of the original unit adsorption rate. Reactivation conditions shall be recommended by the manufacturer (see 4.2.1 and 3.17). However, the reactivation temperature shall be not less than 245°F (118.3°C), and the time for each reactivation shall not exceed 24 hours.

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3.10 Dusting.

3.10.1 Type I (all sizes) and type III (8 and 16 units). When tested as specified in 4.6.6, the weights of dust found shall be in accordance with table II.

TABLE II. Dusting requirements.

Bag size, units	Number of bags tested	At least six of the dust values shall not exceed (mg)	At least eight of the dust values shall not exceed (mg)	No more than two dust values shall be in the range (mg)	No more than one dust value shall exceed (mg)
16	12	5.0	--	60.0 to 200.0	200
8	12	2.5	--	60.0 to 200.0	200
4 and smaller	12	---	0.5	60.0 to 200.0	200

3.10.2 Type II. When tested as specified in 4.6.6, type II desiccant shall produce not more than 1/2 milligram of dust, regardless of bag size.

3.11 Corrosiveness. The bagged desiccant and the desiccant by itself in contact with steel, brass, magnesium, and aluminum shall show no increase in corrosion when tested as specified in 4.6.7.

3.12 Bag durability.

3.12.1 Types I, II and III. Bags in which the desiccant is packaged shall not puncture, tear or burst, and the tie strings shall not break when tested as specified in 4.6.8.

3.12.2 Type III only. Bags in which the desiccant is packaged shall not puncture, tear or burst nor show visible evidence of leaching of the desiccant through the bag material when tested as specified in 4.6.8.4. The test water used for immersion shall contain not more than 5 milligrams of non-combustible material per 8 units of desiccant when tested as specified in 4.6.8.4.1.

3.13 Resistance of bagging material to reactivation temperature. When reactivated and tested as specified in 4.6.9, the desiccant bag shall not puncture, burst, or otherwise fail.

3.14 Bag size. Type I and II desiccants shall be furnished in bags in the fractional unit sizes of 1/6, 1/3, and 1/2; the unit size 1, and the multiple unit sizes of 2, 4, 8 and 16 as specified (see 6.2).

3.14.1 Type III desiccant shall be furnished in bags in the multiple unit sizes of 8 and 16 as specified (see 6.2).

3.15 Tie strings. Unless otherwise specified in the contract or order, bags of 16-unit size or larger shall be provided with tie strings having a minimum length of 7 inches.

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3.16 Particle size. The particle size distribution shall be as shown in table III.

TABLE III. Particle size.

Sieve number	Distribution, percent
1/2 inch[1] 80	Retained (max) 0.0 Retained (min) 96.0

[1] The permissible variation in average openings shall be 3 percent. The permissible variations in maximum openings shall be 5 percent. The wire diameter shall be 0.094 to 0.122 inch.

3.17 Bag markings. Each desiccant bag shall be marked durably and legibly with the following information:

Nomenclature: Desiccant, Activated, Bagged, Packaging Use and Static Dehumidification
Specification: MIL-D-3464
Type I, II, or III, as applicable
Manufacturer's designation
Unit content _____
Reactivation temperature in bag ____ °F
Reactivation time _____ hours
Manufacturer's name and address

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items must meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of assuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling in quality conformance does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to acceptance of defective material.

4.2 Qualification tests. Qualification tests shall be conducted at a laboratory satisfactory to the Naval Sea Systems Command (NAVSEA). Qualification tests shall consist of the tests specified in 4.6.

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4.2.1 Forwarding instructions. Qualification test samples shall be forwarded to a laboratory satisfactory to NAVSEA. These samples shall be plainly identified by securely attached durable tags marked with the following information:

Samples for qualification test
Desiccant, Activated, Bagged, Packaging Use and Static Dehumidification
Unit content _____
Unit weight _____ grams
Bagging material _____
Methods of closure _____
Reactivation temperature _____ °F
Minimum reactivation time _____ hours
Manufacturer's code number _____
Submitted by (manufacturer's name and address and date) for qualification tests in accordance with MIL-D-3464.
Type I, II, or III, as applicable
Location of plant which produced samples
_____
Tests authorized by _____
(reference authorizing letter)

4.2.2 Qualification sample. A qualification sample shall consist of the number of bags listed in table IV for each kind of bag material submitted for qualification.

TABLE IV. Qualification sample size.

Bag size, units	Number of bags	Bag size, units	Number of bags
16	44	1/2	53
8	41	1/3	61
4	39	1/6	86
2	41	---	---
1	45	---	---

4.3 Sampling for quality conformance test.

4.3.1 Lot. A lot shall consist of 1 day's production or of any fractional day's production of one bag size which constitutes completion of a manufacturing run.

4.3.2 Method of sampling. An inspection test sample shall consist of the number of bags of desiccant listed in table V for each different bag material.

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TABLE V. Inspection sample size.

Bag size, units	Number of bags	Bag size, units	Number of bags
16	93	1/2	120
8	84	1/3	144
4	81	1/6	216
2	84	---	---
1	96	---	---

4.3.2.1 The bags shall be opened only at the test laboratory. Each sample shall be divided into three equal representative portions, which shall immediately be placed in clean, dry containers, which, when sealed, shall be air- and moisturetight. Extreme care shall be taken to ensure that the material is exposed for a minimum time, and that the containers are closed and sealed immediately. Each bag shall be given a cursory check to ensure immediate rejection of bags or lots if the bags are punctured or excessively dirty. Samples shall be identified with the name of the manufacturer, name of the material, the specification number, the number of units, the reactivation instructions, the contract number, and the lot number.

4.4 Inspection.

4.4.1 Examination of filled containers. A random sample of filled containers shall be selected from each lot in accordance with MIL-STD-105 at inspection level I, and acceptable quality level of 2.5 percent defective to verify compliance with this specification regarding fill, closure, marking, and other requirements not involving tests. Containers shall be examined for defects of container and closure, for evidence of leakage, and for unsatisfactory markings; each sample-filled container shall also be weighed to determine the amount of the contents. Any container in the sample having one or more defects, or being under required fill, shall not be offered for delivery. If the number of defective containers in any sample exceeds the acceptance number for the appropriate sampling plan of MIL-STD-105, this shall be cause for rejection of the lot represented by the sample.

4.4.2 Quality conformance tests. Each of the samples selected as specified in 4.3.2 shall be subjected to the following tests:

TABLE VI. Quality conformance inspection.

Test	Requirement	Test paragraph
Unit adsorption capacity	3.4.1	4.6.1
Unit volume	3.5	4.6.2
Humidity control	3.8	4.6.3
Unit adsorption rate	3.7	4.6.4
Adsorption capacity after reactivation	3.9	4.6.5
Dusting	3.10	4.6.6
Corrosiveness	3.11	4.6.7
Bag durability	3.12	4.6.8
Resistance of bag to reactivation temperature	3.13	4.6.9
Unit content of package	3.6	4.6.10
Particle size	3.16	4.6.11

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4.4.2.1 In addition to the tests specified in 4.4.2, type III desiccant shall be subjected to the test specified in 4.6.8.4.

4.5 Retests and rejections. Failure of the material to conform to any one of the requirements of this specification during inspection shall be cause for rejection of the lot represented. If, in the opinion of the contractor, the failure was due to faulty test method, the tests may be repeated on the contractor's retained sample. In case of a controversy, the test shall be repeated on the Government retained sample. Failure of any two of the three samples to meet the requirements shall be cause for final rejection of the lot represented.

4.6 Tests.

4.6.1 Unit adsorption capacity.

4.6.1.1 Apparatus. The general arrangement of the apparatus shall be as shown on figure 1. The fitting comprising the inlet, outlet, and petticoat bubbler for each saturator bottle shall have a ground glass stopper to fit the bottle. The saturator bottles and bubbler shall be constructed so that with 1 liter of solution in the bottle the upper holes of the bubbler shall be not more than 3 inches nor less than 1 inch below the surface of the liquid. Each of the six saturator bottles shall be filled with 1 liter of identical sulfuric acid solutions to give the desired relative humidity at 25°C in accordance with table VII.

TABLE VII. Relative humidity solutions.[1]

Solution	Percent by weight	R.H. percent at 25°C	Sp.gr.[2] 20°/4°C	Sp.gr[2] 77°/60°F
H_2SO_4	58.2	20	1.4789	1.4754
H_2SO_4	47.8	40	1.3739	1.3715
H_2SO_4	38.4	60	1.2889	1.2859
H_2SO_4	26.2	80	1.1894	1.1853

[1] Relative humidity represents values that would be obtained in a closed static system. The actual effluent relative humidities will be slightly below these nominal values.

[2] Specific gravity measurements should be made at either indicated temperature using a precision hydrometer with smallest subdivision 0.0005 unit.

4.6.1.1.1 The sample-containing bottle shall be a Nesbitt, Fleming, or other standard form of adsorption bulb. The bulb shall be provided with a suitable closure to prevent diffusion. For routine tests, the temperature of the room in which the tests are being conducted shall be controlled to 25 ± 2°C. For referee tests, the room temperature shall be controlled to plus or minus 1°C. For routine tests, the temperature variation within the saturator bottles, the inlet air, and the sample-containing bottle during any one run shall not exceed plus or minus 1°C. A desiccant trap filled with activated desiccant under test shall be placed in front of the saturator bottles to pick up any adsorptive impurities in the inlet air.

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4.6.1.2 Procedure. A 6- to 10-gram sample of the desiccant shall be weighed to the nearest milligram in the tared adsorption bulb. Care shall be exercised to ensure that the material is exposed to the air for a minimum time. The adsorption bulb shall then be connected to the apparatus and the air flow adjusted to 4 ± 0.5 liters per minute with the by-pass closed. If the manometer indicates the pressure in the last bottle to be greater than 1 inch mercury, the bleed-off line shall then be cracked open until the manometer indicates less than 1 inch and that point maintained for the balance of the run. When using the by-pass, an occasional check shall be made of the amount of air passing through the adsorption bulb by diverting the by-pass air from the flowmeter to atmosphere through the "tee" connection. The flowmeter reading will then indicate the actual air flow through the adsorption bulb. Periodically the adsorption bulb shall be removed from the train, the stopcocks closed and the bulb weighed. This process shall be repeated until two successive weighings, approximately 1 hour apart, show a weight variation not exceeding 5 milligrams. The test shall be considered complete if at any time the minimum specification values are attained. It will generally be found that the weight will rise to a maximum and then decrease slightly before approaching a constant value. The adsorption capacity of the desiccant shall be determined by the following equation for the specified relative humidities.

$$\text{Unit adsorption capacity} = \frac{U\,G}{W}$$

Where:

U = unit weight (grams)
W = original weight of sample taken (grams)
G = Gain in weight of samples (grams)

4.6.1.3 Alternate apparatus. A commercial environmental chamber is suitable as an alternate apparatus for this test. The chamber shall be capable of a relative humidity percent range of 20-80 at 25°C. For routine tests, the temperature of the chamber in which the tests are being conducted shall be controlled to 25 ± 2°C. For referee tests, the chamber temperature shall be controlled to plus or minus 1°C.

4.6.1.4 Alternate procedure. A 6- to 10-gram sample of the desiccant shall be weighed to the nearest milligram on a glass dish. Care shall be exercised to ensure that the material is exposed to the air for a minimum time. The dish shall then be placed in the environmental chamber. Periodically the dish shall be removed from the chamber and weighed. This process shall be repeated until two successive weighings, approximately 1 hour apart, show a weight variation not exceeding 5 milligrams. The test shall be considered complete if at any time the minimum specification values are attained. It will generally be found that the weight will rise to a maximum and then decrease slightly before approaching a constant value. The adsorption capacity of the desiccant shall be determined by the following equation for the specified relative humidities.

$$\text{Unit adsorption capacity} = \frac{U\,G}{W}$$

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Where:

U = unit weight (grams)
W = original weight of sample taken (grams)
G = gain in weight of samples (grams)

4.6.2 Unit volume. A clean, dry, 100 mL graduated cylinder shall be weighed to the nearest 0.1 gram. The cylinder shall be filled to any convenient level with activated desiccant and weighed again. The cylinder shall be tapped on a resilient surface, such as heavy sheet rubber, until the volume of desiccant remains constant between two successive 1-minute tapping periods. The volume of desiccant in the graduated cylinder shall be read. The unit volume shall be calculated by the following formula:

$$\text{Unit volume} = \frac{U\ V}{W}$$

Where:

U = unit weight (grams)
W = original weight of sample taken (grams)
V = volume of sample as read in the graduate (mL)

4.6.3 Humidity control.

4.6.3.1 Apparatus. The apparatus shall consist of an open end steel box (see figure 2) measuring 12 by 12 by 11 inches having a flanged, removable 1/4-inch brass cover on the open end and painted on the outside with aluminum paint. The brass cover shall be held to the box by 24 evenly-spaced wing bolts. The box shall have an internal open end copper shell, 10 by 10 by 10 inches, evenly spaced from all sides except the covered side. The surrounding side shall be filled with glass wool insulation. The brass cover of the box shall be provided with an access port sealed with a no. 13 rubber stopper for the introduction of the desiccant. One insulated wall shall have attached the necessary instrumentation for the accurate measurement of temperature and R.H. (plus or minus 1-1/2 percent R.H.) under static conditions. A cylinder 1-3/8 inches in diameter and 3 inches long, fabricated from 100-mesh copper screening shall be attached to the small end of the no. 13 rubber stopper.

4.6.3.2 Procedure. Suspend 125 to 150 grams of activated desiccant in a bag inside the box and close it with a no. 13 stopper without the copper screen sample holder. Place the box and desiccant in an oven at 38 ± 1°C until the relative humidity within the box remains at approximately zero for 4 hours. Leave the box in the oven, but withdraw the bag of desiccant. Fill the copper screen cylinder with one unit of the desiccant test sample. Pour 5 mL of water onto the floor of the box and then insert a no. 13 stopper with a copper screen cylinder of desiccant attached. Allow the apparatus to come to equilibrium humidity by letting stand overnight at 38 ± 1°C. Place the box in a refrigerator maintained at 5 ± 2°C. Read the temperature and relative humidity in the box at 15-minute intervals for a period of 5 hours and record the maximum relative humidity attained. The temperature drop shall be not less than 1.8°F (1°C) nor greater than 10.8°F (6°C) in any 10-minute interval during the first hour of cooling.

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4.6.4 Unit adsorption rate.

4.6.4.1 Apparatus. The apparatus shall consist of a bell jar of 5- to 10-liter capacity fitted with an air inlet at the top and open to the atmosphere at the bottom or a wide mouth jar with a stoppered inlet at the top and a hole near the bottom open to the atmosphere. The test container shall be large enough to allow the free flow of air over all of the surface of the bag and not be in contact with any part of the bag. The flow of air in the test container shall be from the top air inlet to the bottom of the container. Saturator bottles for supplying air to the test container shall be similar to those specified in 4.6.1.1. The concentrations of sulfuric acid specified in table VII for 40 percent and 80 percent R.H. shall be employed.

4.6.4.2 Procedure. Accurately weigh the bag with its contents. Immediately suspend the bag in a jar by its strings or by a spring clamp. Start the air flowing through the saturation bottles at the rate of 4 ± 1/2 liters per minute, passing the effluent air into the inlet tube of the jar. After 7 hours, remove the bag and weigh. Calculate the unit adsorption rate as follows:

$$\text{Unit adsorption rate} = \frac{G}{U}$$

Where:

G = gain in weight of bagged desiccant (grams)
U = unit content marked on the bag

4.6.5 Adsorption capacity and rate after reactivation. Suspend two bags of desiccant in an enclosed atmosphere at 25 ± 1°C over an open container of water for a minimum of 16 hours. Remove the bags and suspend them in a circulating air type oven at the reactivation conditions recommended by the manufacturer (see 3.17). Repeat the above saturation and reactivation. Place in a desiccator and cool. Determine the unit adsorption capacity of the contents of one bag of desiccant in accordance with 4.6.1, except that the determination shall be made and reported at 40 percent R.H. only. Determine the unit adsorption rate on the other bag in accordance with 4.6.4 except that the determination shall be made and reported at 80 percent R.H. only.

4.6.6 Dusting.

4.6.6.1 Apparatus. The container used for the determination for 16-unit and smaller bags shall consist of an approximately 3-gallon can with fully removable lid in accordance with MS27684. The inside of the can shall be cleaned to the metallic surface. All internal seams shall be leaded or soldered and worked smooth to an even uniform surface. The vibrating apparatus shall consist of a table that can be moved in a circular vibratory motion in a vertical plane by an eccentric with a 1/2-inch throw at 300 ± 5 cycles per minute.

4.6.6.2 Procedure. Place the desiccant bag combination to be tested in the cleaned test container in such a manner that the bag is flat on the bottom of the container with the printed legend up and in a readable position. Whenever the bag is too large to lie flat in the container it shall be positioned so that the bottom portion of the bag lies along the bottom seam of the container with the upper portion of the bag resting on the vertical surface diametrically

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opposite. The cover of the container shall be tightened in place and the container firmly attached to the vibratory table. The container and contents shall be vibrated for 30 minutes. At the completion of the vibration period, the container shall be opened carefully and any dust on the inside surface of the cover shall be brushed into the container with a camel-hair brush. The desiccant bag combination shall be removed from the can and any adhering dust brushed from the surface of the bag into the container. The dust collected in the container shall be brushed into a dried weighing bottle with top affixed and carefully and quickly weighed. Twelve 16-unit or smaller bags shall be run from each lot being tested. All dust values shall be reported.

4.6.7 Corrosiveness. Grind 20 grams of desiccant, retaining the portion that passes a U.S. No. 40 sieve and is held on a U.S. No. 80 sieve in accordance with RR-S-366. Place this 40 to 80 mesh material in a desiccator maintained at 25°C and 60 percent R.H. for a minimum of 24 hours. In a similar fashion place four bags of desiccant in a desiccator maintained at 25°C and 60 percent R.H. for a minimum of 24 hours. Prepare a 2- by 1- by 1/8-inch and a 14- by 4- by 1/4-inch specimen each of hot rolled steel in accordance with ASTM A 569, brass in accordance with QQ-B-637, magnesium alloy in accordance with condition O of QQ-M-44, and aluminum in accordance with condition T3 of QQ-A-250/4 by grinding and polishing one surface to 6 to 8 root mean square microinches. Clean two panels of each metal by successive treatments with:

(a) Hot toluene (210°F), 2 minutes immersion.
(b) Hot acetone (120°F), quick rinse.
(c) Hot methanol (120°F), quick rinse.

During and after cleaning, handle the panels either with forceps and on the edge only, or with wire loops passing through holes previously drilled near one corner. Do not blot dry, but immediately after the methanol rinse, dry each panel for 1 to 2 (but not more than 2) minutes in an oven at 100°F. Cover one-half of each small panel with unbagged desiccant, and cover one-half of each large panel with a bag of desiccant and place the panels in a desiccator maintained at 60 percent R.H. by sulfuric solution in accordance with table VII. Place the desiccator in an oven maintained at 38 ± 1°C for 72 hours. Remove the panels from the desiccator, carefully brush with a camel-hair brush, and visually compare the covered and uncovered surfaces for extent of corrosion.

4.6.8 Bag durability.

4.6.8.1 Strength of bag as received. Remove a bag of desiccant from the shipping container and drop it 20 times from a height of 10 feet to a concrete surface so that it lands on its large flat side but not on its edge or end. Examine the bag for puncturing, bursting, or other failure. Replicate to a total of three bags for each lot. If one of the bags tested fails, seven additional desiccant-bag combinations shall be tested. Cause for rejection shall be failure of two out of 10 bags at from 10 to 20 test drops or failure of any one bag at 10 or less test drops.

4.6.8.2 Strength of bags at low temperature. Store three representative desiccant-bag combinations in a constant temperature box at minus 40 ± 5°C for 6 hours. Then remove from temperature box and immediately drop each bag three times in 15 seconds from a height of 10 feet to a concrete surface so that

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they land on their large flat sides, but not on their edges or ends. Examine for evidence of puncturing, bursting, or other failure. If one of the bags fails, seven additional desiccant-bag combinations shall be tested, of which none shall fail.

4.6.8.3 Vibration resistance. When tie strings are provided, fasten three representative bags by their tie strings to a backboard mounted on a vibration table having a circular vibratory motion of 300 cycles per minute and an amplitude of plus or minus 1/2 inch in the vertical plane. Make the suspension so that the bags are on the right-hand face of the backboard when viewed from the end on which the rotation of the eccentrics is clockwise. Attach the tie strings to the screw hooks on the backboard so that the strings are as close to vertical as possible, consistent with the type of tie strings and bag, and 1/2 inch from the backboard, with the top of the bag 3 ± 1/2 inches below the hooks and the bottom of the bag not less than 1/2 inch above the table as the bag rests against the backboard when the machine is idle. Vibrate for a 2-hour period and inspect the bags for rupture of the seams. Tie strings shall not break nor cause failure of the bag by effecting breaking or tearing or the severance of over two stitches on each end of the sewn seam which secures the tie strings to the bag.

4.6.8.4 Resistance to hot water (type III only). Three representative desiccant bag combinations shall be individually and completely immersed in distilled water and maintained at a temperature of 200 ± 5°F for a period of 2 hours. Upon completion of the immersion period, the bags shall be removed from the water and immediately subjected to the test specified in 4.6.8.1. Cause for rejection shall be as specified in 4.6.8.1.

4.6.8.4.1 The water in which the desiccant bag was immersed shall be filtered through a no. 41 Whatman filter paper or equal. The filter paper containing the residue shall then be placed in a tared platinum crucible, slowly charred, and then ignited in a furnace at a temperature of 1000 to 1050°C for a period of 1 hour. The crucible shall then be removed, placed in a desiccator, allowed to cool and reweighed. The amount of noncombustible material for eight units of desiccant shall be computed as follows:

$$\frac{\text{Initial wt of crucible - final wt of crucible}}{\text{Unit size of bag tested}} \times 8 = \text{Wt of noncombustible/8 units of desiccant}$$

The average value obtained for three determinations shall be reported.

4.6.9 Resistance of bag to reactivation temperature. Reactivate three representative bags of desiccants, in accordance with manufacturer's instructions (see 4.2.1). Cool to room temperature in a desiccator. Remove from the desiccator and drop each separately three times from a height of 10 feet to a concrete surface so that they land on their large flat side but not on their edge or end. Examine the bags carefully for evidence of puncturing, bursting, or other failure.

4.6.10 Unit content of package. Weigh a clean, dry beaker and empty the entire contents of a representative bag into it and reweigh. Determine unit content of bag by the following formula:

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$$\text{Unit content} = \frac{A - B}{C}$$

Where:

A = Weight of beaker and desiccant in grams
B = Weight of empty beaker in grams
C = Unit weight in grams

4.6.11 Particle size.

4.6.11.1 Apparatus. The shaker to be employed in conducting particle-size tests shall operate with a single eccentric circular motion at 285 ± 10 revolutions per minute and with a tapping action of 150 ± 5 strokes per minute to obtain dependable sieve analysis. To permit flexible operation, the shaker shall accommodate one to six 8-inch sieves with one pan and cover.

4.6.11.2 Procedure. Nest the sieves in the order of decreasing sizes with the largest sieve on top and a pan at the bottom. Weigh a sample of approximately 150 grams of the material and place it on the top sieve of the nest. Place the nest of sieves with the cover in the testing machine and vibrate for 3 minutes plus or minus 3 seconds with a tapper in operation. Weigh the residue on each sieve to within 0.5 gram and calculate the percentage of desiccant retained on each sieve immediately following the shaker operation. Use the sum of all individually retained weights as the total weight of the sample.

4.7 Inspection of packaging. Sample packages and packs, and the inspection of the preservation-packaging, packing and marking for shipment and storage shall be in accordance with the requirements of section 5 and the documents specified therein.

5. PACKAGING

(The packaging requirements specified herein apply only for direct Government acquisition. For the extent of applicability of the packaging requirements of referenced documents listed in section 2, see 6.5.)

5.1 Preservation-packaging. Preservation-packaging shall be level A or C, as specified (see 6.2).

5.1.1 Quantity per container. Bags of desiccant of one size shall be packaged in containers of uniform capacity. The containers shall be approximately full and bagged desiccant packaged to avoid damage to the packaging material. The quantity of bags per container per bag size, shall be as follows:

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Bag size	5-gallon can No. of bags	5-gallon pail No. of bags
1/6	1200	1200
1/3	650	700
1/2	450	550
1	250	300
2	130	150

Bag size	22-gallon 24-gauge drum No. of bags	200-pound capacity drums No. of bags
1	1000	1300
2	650	800
4	400	500
8	240	300
16	120	150

5.1.2 Each container enclosing bagged desiccant shall contain at least one humidity indicator card in accordance with MS26507 which meets all of the requirements of MIL-I-8835. No cushioning or overpacking shall be included in containers.

5.1.3 Level A.

5.1.3.1 Five-gallon can. The 5-gallon capacity cans shall be in accordance with type V, square, of PPP-C-96. Where cans are made of electrolytic tinplate, the tin coating shall be approximately 0.50 pound per base box of 112 sheets, 14 by 20 inches (see 6.2). Cans shall be provided with a top opening of 6-15/16 inches in diameter and fitted with a leak-proof multiple-friction plug type closure. Handles will not be required.

5.1.3.2 Five-gallon pail. The 5-gallon capacity pail shall be in accordance with type II, class 3 of PPP-P-704 (see 6.2).

5.1.3.3 Drums.

5.1.3.3.1 Metal drums. Unless otherwise specified (see 6.2), metal drums shall be of 24-gauge construction in accordance with 178.131 of Department of Transportation Specification 37A. Drums shall be provided with leakproof, air-tight bolt locking ring type covers. Each movable cover shall be fitted with a tubular flowed-in or sponge rubber gasket. The gasket shall be securely affixed so that it will remain in place when the cover is removed. The entire exterior surfaces of the drums shall be protected with a corrosion-resistant coating in accordance with type II of TT-E-485. Drum dimensions shall be as follows:

Capacity gallons	Dimensions (approximate inside) Height inches	Diameter inches
22	21	18
30 (200 pounds)	27-11/16	18-1/4

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5.1.3.3.2 Fiber drums. When specified (see 6.2), fiber drums in accordance with PPP-D-723, type III, grade A, class 2, may be used for packaging the 200-pound capacity quantities.

5.1.4 Level C. The bagged desiccant shall be packaged in leakproof, airtight containers which shall provide protection against deterioration, moisture pick-up and damage during shipment from the supply source to the first receiving activity for immediate use. Fiber drums, when used, shall be in accordance with PPP-D-723, type I, grade A, class 2.

5.2 Packing. Packing shall be level A, B, or C as specified (see 6.2).

5.2.1 Level A.

5.2.1.1 Cans shall be arranged and packed level A in accordance with the appendix to PPP-C-96.

5.2.1.2 Pails and drums will require no further packing. When specified (see 6.2), pails and drums shall be palletized for shipment in accordance with MIL-STD-147.

5.2.2 Level B.

5.2.2.1 Cans shall be arranged and packed level B in accordance with the appendix to PPP-C-96.

5.2.2.2 Pails and drums will require no further packing. When specified (see 6.2), pails and drums shall be palletized for shipment in accordance with MIL-STD-147.

5.2.3 Level C. The bagged desiccant, packaged as specified, shall be packed in a manner which will ensure arrival at the destination in satisfactory condition and which will be acceptable to the carrier at lowest rates. Containers and packing shall conform to the Uniform Freight Classification Rules, National Motor Freight Classification Rules or other carrier regulations as applicable to the mode of transportation.

5.3 Marking. In addition to any special marking required (see 6.2), interior packages, exterior shipping containers and palletized unit loads shall be marked in accordance with MIL-STD-129. Each container shall be marked with the following additional information:

"Caution: This container contains desiccant. Due to the moisture properties of desiccant, this container positively must not be opened for any longer period than is absolutely necessary for withdrawals. Withdrawals shall be limited to the quantity intended to be used. The container shall be tightly resealed immediately after any withdrawal."

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6. NOTES

6.1 Intended use. Bagged desiccants covered by this specification are intended for use in removing moisture from gases, including air, and liquids, as follows:

(a) Generally applicable for static dehumidification of packages and closed spaces in order to prevent corrosion, mold, or mildew.
(b) Method II packaging. The use of desiccants in method II packaging is covered by MIL-P-116, which also specifies formulae for computing the proper quantity of desiccant to be used.
(c) Type III desiccant in 8 and 16 unit bags is intended for use in areas where a danger exists of accidental flooding by water (200°F maximum). The durability of the bag material, and seams thereof, should be sufficient to prevent contamination of a system by accidental dispersal of desiccant material.
(d) Type II desiccant is intended for use in critical packaging applications where dusting cannot be tolerated.

6.1.1 This specification is intended for use in the acquisition of new bagged desiccant.

6.2 Ordering data. Acquisition documents should specify the following:

(a) Title, number, and date of this specification.
(b) Type of desiccant required (see 1.2).
(c) Number of units per bag (see 3.14 and 3.14.1).
(d) Applicable level of preservation-packaging and packing required (see 5.1 and 5.2).
(e) Size container required (see 5.1.3.1 and 5.1.3.2).
(f) When other than 24-gauge drums are required (see 5.1.3.3.1).
(g) When bagged desiccant may be furnished in fiber drums (see 5.1.3.3.2).
(h) When palletization of pails and drums is required (see 5.2.1.2 and 5.2.2.2).
(i) Special marking required (see 5.3).

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time set for opening of bids, qualified for inclusion in Qualified Products List QPL-3464 whether or not such products have actually been so listed by that date. The attention of the contractors is called to these requirements, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or purchase orders for the products covered by this specification. The activity responsible for the Qualified Products List is the Naval Sea Systems Command, SEA 55Z3, Department of the Navy, Washington, DC 20362-5101 and information pertaining to qualification of products may be obtained from that activity. Application for qualification tests shall be made in accordance with "Provisions Governing Qualification SD-6" (see 6.3.1).

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6.3.1 Copies of "Provisions Governing Qualification SD-6" may be obtained upon application to Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.

6.4 Particular attention should be paid to acquisition of the smallest size exterior container commensurate with the probable rate of use of the desiccant. The material rapidly loses its dehydrating strength when exposed to air so that use of containers requiring a minimum of openings will help ensure most efficient use of the desiccant.

6.5 Sub-contracted material and parts. The packaging requirements of referenced documents listed in section 2 do not apply when material and parts are acquired by the contractor for incorporation into the equipment and lose their separate identity when the equipment is shipped.

6.6 Subject term (key word) listing.

Adsorption
Dessicant, activated
Dusting
Reactivation

6.7 Changes from previous issue. Asterisks are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

Custodians:
Army - EA
Navy - SH
Air Force - 68

Review activities:
Army - MI, AT
Navy - SA, AS, OS
DLA - GS, DS

User activities:
Navy - CG
Army - ME, AR, SM

Preparing activity:
Navy - SH
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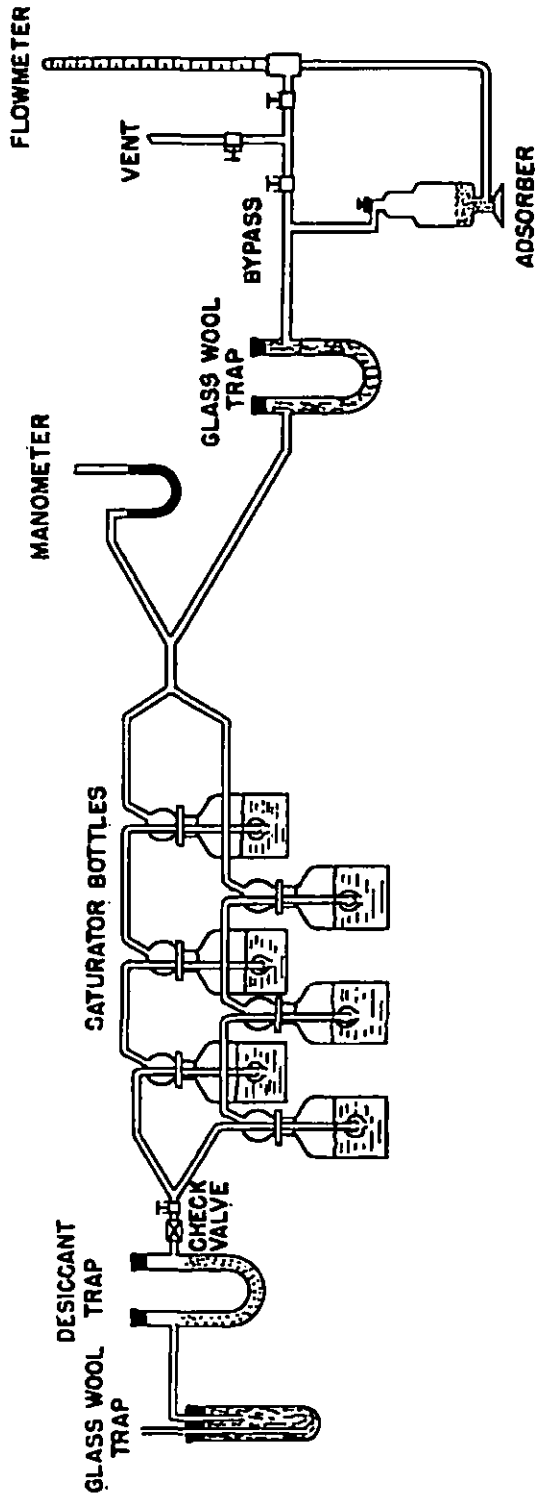

FIGURE 1. Apparatus for water vapor adsorption capacity test.

SH 469

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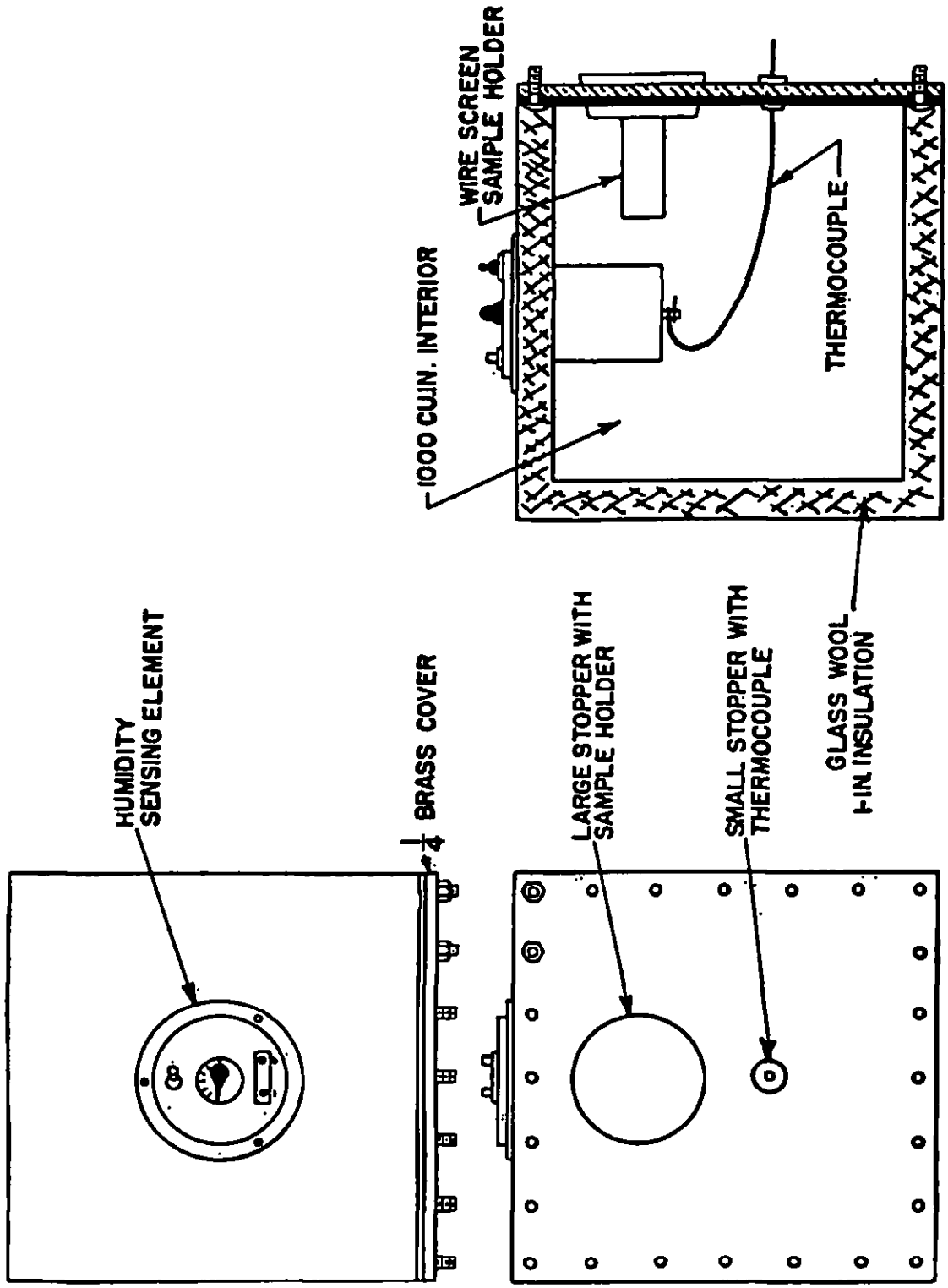

FIGURE 2. Apparatus for humidity control test.

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STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions – Reverse Side)

1. DOCUMENT NUMBER	2. DOCUMENT TITLE
MIL-D-3464E	Desiccants, Activated, Bagged, Packing Use and Static

3a. NAME OF SUBMITTING ORGANIZATION	4. TYPE OF ORGANIZATION *(Mark one)*
	☐ VENDOR
b. ADDRESS *(Street, City, State, ZIP Code)*	☐ USER
	☐ MANUFACTURER
	☐ OTHER *(Specify)*: _____

5. PROBLEM AREAS

a. Paragraph Number and Wording:

b. Recommended Wording:

c. Reason/Rationale for Recommendation:

6. REMARKS

7a. NAME OF SUBMITTER *(Last, First, MI)* – Optional	b. WORK TELEPHONE NUMBER *(Include Area Code)* – Optional
c. MAILING ADDRESS *(Street, City, State, ZIP Code)* – Optional	8. DATE OF SUBMISSION *(YYMMDD)*

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