

MIL-A-3316B**29 APRIL 1966****SUPERSEDING****MIL-A-3316A****19 NOVEMBER 1960****(SEE 6.2 AND 6.5).****MILITARY SPECIFICATION****ADHESIVES, FIRE-RESISTANT,
THERMAL INSULATION**

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

1. SCOPE

1.1 Scope. This specification covers fire-resistant adhesives for securing cloth and tape to certain thermal insulations and for securing certain thermal insulations to metal surfaces.

1.2 Classification. The adhesives shall be of the following classes, as specified (see 6.1):

Class 1

For bonding fibrous glass cloth to unfaced fibrous glass insulation.

For bonding cotton brattice cloth to faced and unfaced fibrous glass insulation board.

For sealing the edges of, and bonding fibrous glass tape to the joints of, fibrous glass board.

For bonding lagging cloth to thermal insulation.

Class 2

For attaching fibrous glass insulation to metal surfaces.

Class 3

For attaching cork and fibrous glass insulation board to metal surfaces.

2. APPLICABLE DOCUMENTS

2.1 The following documents of the issue in effect on date of invitation for bids or request for proposal, form a part of the specification to the extent specified herein.

SPECIFICATIONS**FEDERAL**

HH-I-525	— Insulation Board, Thermal, Cork.
PPP-C-96	— Cans, Metal, 28 Gage and Lighter.
PPP-C-704	— Pails: Shipping, Steel (1 through 12-gal-lon).

FSC 8040

MIL A-3316B**MILITARY**

MIL-I-742 — Insulation Board, Thermal, Fibrous Glass.

MIL-C-768 — Cloth, Brattice, Cotton, Fire-Resistant.

MIL-E-17970 — Enamel, Nonflaming (Dry) Chlorinated Alkyd Resin, Soft White, Semigloss, Formula No. 124/58.

MIL-C-20079 — Cloth, Glass; Tape, Textile, Glass; and Thread, Glass.

MIL-I-22023 — Inspection Felt, Thermal and Sound Absorbing Felt, Fibrous Glass, Flexible.

STANDARDS**FEDERAL**

FED-STD-141 — Paint, Varnish, Lquer, and Related Materials; Methods of Inspection, Sampling, and Testing.

MILITARY

MIL-STD-105 — Sampling Procedures and Tables for Inspection by Attributes.

MIL-STD-129 — Marking for Shipment and Storage.

(Copies of specifications, standards, drawings, and publications required by suppliers in connection with specific procurement actions should be obtained from the procuring activity or as directed by the contracting officer.)

22 Other publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply.

AMERICAN SOCIETY FOR TESTING AND MATERIALS

D92 — Method of Test for Flash and Fire Points by Cleveland Open Cup.

D217 — Method of Test for Cone Penetration of Lubricating Grease.

D781 — Method of Test for Puncture and Stiffness of Paperboard, Corrugated and Solid Fiberboard.

D903 — Method of Test for Peel or Stripping Strength of Adhesives.

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

AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS

Threshold Limit Values (For Atmospheric Contaminants)

(Application for copies should be addressed to the American Conference of Governmental Industrial Hygienists, 1014 Broadway, Cincinnati 2, Ohio).

OFFICIAL CLASSIFICATION COMMITTEE

Uniform Freight Classification Rules

(Application for copies should be addressed to the Official Classification Committee, 1 Park Avenue at 33rd Street, New York, N. Y. 10016).

(Technical society and technical association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies.)

3. REQUIREMENTS

3.1 Qualification. The adhesive furnished under this specification shall be products which are qualified 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. The adhesives shall be effective for the purpose intended without heating or the addition of other ingredients. They shall be free of all ingredients which may adversely affect the serviceability, have a deleterious effect on thermal insulation and cotton brattice cloth, or cause corrosion of bare steel in the adhesion tests or primed steel in service.

3.3 Stability.

3.3.1 Storage stability. The adhesives shall meet the requirements specified herein when inspected as specified in 4.4.2.1 upon the completion of storage for a period of 6 months in an airtight container.

3.3.2 Freeze-thaw stability. The adhesive shall meet the requirements specified herein when inspected as specified in 4.4.4 through 4.4.13 upon returning to room temperature after subjection to a temperature of 16°F. for 16 hours, as specified in 4.4.2.2.

3.4 Toxicity and irritancy. The material shall have no adverse effect on the health of personnel when used for its intended purposes. Solvents used in the adhesives shall have threshold limit values of not less than 350 parts per million, as specified in publication "Threshold Limit Values."

3.5 Flash point.

3.5.1 Class 1 adhesive. The flash point of the adhesive shall be higher than 110°F. when tested as specified in 4.4.4.

3.5.2 Classes 2 and 3 adhesives. The flash point of the adhesives shall be higher than 80°F. when tested as specified in 4.4.4.

3.6 Consistency.

3.6.1 Classes 1 and 2 adhesives. The consistency of the adhesive shall be not less than 90 nor more than 130 Krebs units when tested as specified in 4.4.5.1.

3.6.2 Class 3 adhesive. The consistency of the adhesive shall be such as to allow a cone penetration average of not less than 25 nor more than 35mm when tested as specified in 4.4.5.2.

3.7 Coverage and finished weight (class 1 adhesive only). The coverage obtained from the adhesive in producing a satisfactory covering shall be not less than 30 square feet per gallon for each specimen when tested as specified in 4.4.6. The finished weight of the covering for each specimen shall not be more than 5.35 ounces per square foot of application.

3.8 Adhesive strength.

3.8.1 Strength before drying (class 1 adhesive only). The strength of the adhesive before drying, when tested as specified in 4.4.7.1, shall be sufficient to prevent cotton brattice cloth from peeling away more than one inch at any point from the faced and unfaced surfaces of vertically mounted fibrous glass insulation board and from the lower (faced and unfaced) surfaces of horizontally mounted fibrous glass insulation board.

3.8.2 Drying time and stripping strength.

3.8.2.1 Class 1 adhesive only. The adhesive shall dry to touch within a period of 48 hours, and shall have an average adhesive strength of not less than 3 pounds when tested as specified in 4.4.7.2.1.

3.8.2.2 Classes 2 and 3 adhesive. All specimens shall have an adhesive strength of not less than 300 grams when tested as specified in 4.4.7.2.2.

MIL-A-3316B

3.8.3 Tensile adhesive strength (class 3 adhesive only). The adhesive strength shall be not less than:

- (a) 125 pounds when tested as specified in 4.4.7.3.2.
- (b) 100 pounds when tested as specified in 4.4.7.3.3.
- (c) 50 pounds when tested as specified in 4.4.7.3.4.

The adhesive shall be considered as conforming to the strength requirements when failure occurs in the cork at a strength lower than that specified for the adhesive, except that failure at less than 50 lbs. shall result in a retest using cork selected for greater strength.

3.9 Color (class 1 adhesive). The adhesive, when examined as specified in 4.4.8 shall be white in color.

3.10 Flexibility (all classes). The adhesive shall not develop cracks deep enough to expose the substrate when tested as specified in 4.4.9. Cracks occurring at either end and extending not more than $\frac{1}{4}$ inch shall be disregarded.

3.11 Washability (class 1 adhesive only). The adhesive shall be washable to the extent that there shall be no definite break-through or detachment of the adhesive when tested as specified in 4.4.10.

3.12 Paintability (class 1 adhesive only). The adhesive shall not cause discoloration or bleeding through enamel conforming to MIL-E-17970, shall not cause cracking or crazing of the enamel, and shall be compatible with the enamel when tested as specified in 4.4.11.

3.13 Fire Resistance.

3.13.1 Vertical specimen test (all classes). There shall be no residual flame or continu-

ous burning of any specimen for more than 3 seconds after the test flame is extinguished when tested as specified in 4.4.12.1.

3.13.2 Horizontal panel test.

3.13.2.1 Class 1 adhesive. When the adhesive is tested as specified in 4.4.12.2.1 and 4.4.12.2.3, no sustained flaming shall issue from any specimen. Any flame which occurs shall be limited to intermittent short flames from the area directly exposed to the test flames. No flame or glow from the specimen shall reach the angle frame at any point during or after the test period. Flaming shall not continue more than 2 minutes after the burner flame is extinguished. At no time during the test period shall any piece of the specimen having an area greater than 10 square inches fall from the specimen.

3.13.2.2 Classes 2 and 3 adhesives. The adhesives shall flame only intermittently when tested as specified in 4.4.12.2.2 and 4.4.12.2.3, and it shall not smolder after that test. When the insulation board is pulled off the steel plate, the separation shall occur within the fibrous glass insulation rather than between the fibrous glass insulation and the steel plate.

3.14 Puncture resistance (class 1 only). The puncture resistance of the finished covering shall be not less than 800 inch-ounces per inch of tear when tested as specified in 4.4.13.

3.15 Workmanship. When examined as specified in 4.4.14, the adhesive shall be free from grit, lumps and skins.

3.16 Unit container content. When examined in accordance with 4.4.15, the unit container shall contain not less than the capacity specified in 5.1.

4. QUALITY ASSURANCE PROVISIONS

MIL-A-3316B

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the supplier may utilize his own facilities or any commercial laboratory acceptable to 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.

4.2 Qualification tests¹. Qualification tests

shall be conducted at a laboratory satisfactory to the Bureau of Ships. Qualification tests shall consist of the tests specified in 4.4.2 through 4.4.14.

4.3 Quality conformance inspection.

4.3.1 Inspection procedures. Each lot of adhesive offered for acceptance shall receive a quality conformance inspection, which shall consist of the examinations and tests as specified in table I.—Pre-conditioning shall be as specified in 4.4.2.2, and test conditions shall be as specified in 4.4.3 or as specified in the applicable test paragraph.

¹ Application for Qualification tests shall be made in accordance with "Provisions Governing Qualification" (see 6.3 and 6.4).

MIL-A-3316B

TABLE I. Quality conformance inspection

Characteristics	Requirement (paragraph)			Inspection procedure (paragraph)			Sampling data	
	Adhesive class			Adhesive class			Sample units to be tested (4.2.3)	Sample unit
	1	2	3	1	2	3		
Freeze-thaw stability	3.3.2	3.3.2	3.3.2	4.4.2.2	4.4.2.2	4.4.2.2	Nos. 1, 2, 3	
Flash point	3.5.1	3.5.2	3.5.2	4.4.4	4.4.4	4.4.4	No. 2	
Consistency	3.6.1	3.6.1	3.6.2	4.4.5.1	4.4.5.1	4.4.5.2	Nos. 1, 2, 3	
Adhesive strength	3.8.1, 3.8.2	3.8.2	3.8.2, 3.8.3	4.4.7.1, 4.4.7.2.1	4.4.7.2.2	4.4.7.2.2, 4.4.7.3	No. 2	Quart
Color	3.9	—	—	4.4.8	—	—	No. 2	
Flexibility	3.10	3.10	3.10	4.4.9.1	4.4.9.2	4.4.9.2	No. 2	
Fire resistance	3.13.1	3.13.1	3.13.1	4.4.12.1	4.4.12.1	4.4.12.1	No. 2	
Workmanship	3.15	3.15	3.15	4.4.14	4.4.14	4.4.14	Nos. 1, 2, 3	
Unit container content	3.16	3.16	3.16	4.4.1, 4.4.15	4.4.1, 4.4.15	4.4.1, 4.4.15	No. 2 and Table II	Filled unit container
Packaging	5.1	5.1	5.1	4.4.16	4.4.16	4.4.16	See 5.1	
Marking of unit container.	5.3	5.3	5.3	4.4.16	4.4.16	4.4.16	Table II	
Packing	5.2	5.2	5.2	4.4.16	4.4.16	4.4.16	5.2	Filled shipping container
Marking of shipping container.	5.3	5.3	5.3	4.4.16	4.4.16	4.4.16	Table II	

MIL-A-3316B

4.3.2 Sampling.

4.3.2.1 *Lot.* For the purpose of the sampling plan, an inspection lot shall consist of all adhesive processed in one batch and offered for delivery at one time.

4.3.2.2 *Sampling for quality of adhesive.* Sampling, except for the examination of filled containers, shall consist of three one-quart sample units from each batch taken from the pouring station of the batch-mixing tank. The tank shall be adequately stirred. To obtain assurance of adequate stirring, the one-quart containers shall be taken as follows:

No. 1—As emptying of the tank begins.

No. 2—As the tank is half empty.

No. 3—As the tank is nearly empty.

The tests to be performed on these one-quart sample units shall be as specified in table I. Should any one-quart sample unit fail in any test, the batch shall be rejected.

4.3.2.3 *Sampling for examination of filled containers.* A random sample of filled unit containers shall be taken in accordance with table II, and examined in accordance with 4.4.15. The instituting of, and the sampling for tightened or reduced inspection shall be in accordance with MIL-STD-105, inspection level I, AQL 2.5 percent defective.

TABLE II. Sampling for examination of filled containers.

Batch size: No. of filled unit containers	Sample size: No. of filled containers to be taken	No. of defects	
		Acceptance No.	Rejection No.
150 or less	5	0	1
151 to 500	20	1	2
501 to 1200	32	2	3

TABLE II. Sampling for examination of filled containers.
—(Cont'd)

Batch size: No. of filled unit containers	Sample size: No. of filled containers to be taken	No. of defects	
		Acceptance No.	Rejection No.
1201 to 3200	50	3	4
3201 to 10,000	80	5	6

4.3.2.3.1 *Rejected lots for examination.* A lot which is submitted for examination after being rejected for failure to meet one or more of the requirements specified in 3.16 or 5.3 or a lot submitted in place of a rejected lot, shall be given a tightened inspection to determine conformance with the requirements which the original lot failed to meet. Any lot rejected in accordance with the sampling plan may nevertheless be accepted by examination of all unit containers in the lot and removal of all defectives.

4.4 Tests.

4.4.1 *Weight per gallon.* One-quart container No. 2 shall be thoroughly mixed. The weight per gallon of its contents shall be determined by method 4184 of FED-STD-141, for use in the calculation specified in 4.4.15.

4.4.2 *Stability.*

4.4.2.1 *Storage stability.* The adhesive shall be stored for a period of 6 months in an airtight container. At the end of this period, the adhesive shall be inspected as specified in 4.4.2 through 4.4.14.

4.4.2.2 *Freeze-thaw stability.* Prior to the performance of any inspections specified in 4.4.4 through 4.4.14, the three one-quart containers of the sample shall be subjected to a temperature of 16°F. \pm 2°F. for a

MIL-A 3316B

period of 16 hours, shall then be allowed to return to room temperature, and shall then be mixed thoroughly at low speed just prior to performance of the remaining tests and examinations.

4.4.3 Temperature and humidity. Drying, curing, conditioning, and testing during the inspections specified in 4.4.4 through 4.4.12 shall be conducted at a room temperature of $80^{\circ}\text{F.} \pm 10^{\circ}\text{F.}$ and at a relative humidity of 50 percent ± 20 percent.

4.4.4 Flash point. The flash point of the adhesive shall be determined in accordance with ASTM D92 with the addition that throughout the test the adhesive shall be stirred sufficiently to prevent skinning or surface segregation.

4.4.5 Consistency.

4.4.5.1 Classes 1 and 2 adhesives. The consistency of the adhesive shall be determined in accordance with method 4281 of FED-STD-141.

4.4.5.2 Class 3 adhesive.

4.4.5.2.1 Apparatus. The apparatus used shall be as specified in ASTM D217, except that the total weight of the cone and rod shall be 75 grams.

4.4.5.2.2 Procedure. The open cup portion of the grease-worker shall be completely filled with the well-mixed sample at a temperature of $77^{\circ}\text{F.} \pm 1^{\circ}\text{F.}$ A straightedge shall be drawn across the surface of the sample to remove any excess material and to present a smooth surface. The apparatus shall be leveled and the plunger lowered until the tip of the penetrometer cone just touches the surface of the sample. The seal shall then be adjusted so that the scale actuating device is in contact with the top of the rod holding the penetrometer cone and the scale reading recorded. The plunger shall be released suddenly and kept released for 5 seconds. The scale-actuating

device shall be moved until it is again in contact with the top of the rod holding the penetrometer cone, and the scale reading recorded. The penetration is the difference between the two readings. Five tests shall be made and the average reported. All tests shall be performed with sufficient rapidity to guard against non-uniformity due to evaporation or skimming. The sample shall be smoothed over before each test.

4.4.6 Coverage and finished weight (class 1 adhesive only). A prime or underlying coat of adhesive shall be applied to the facing of a 1-foot-square section of type I fibrous glass insulation board, conforming to MIL-I-742. A 1-foot-square piece of cotton brattice cloth conforming to MIL-C-788 shall then be immediately superimposed upon the primed surface of each board and hand-troweled smooth, eliminating air pockets. An overlying or finish coat of adhesive shall then be brushed over the cotton cloth. Each specimen shall be weighed before and after application of the adhesive. The volume of the adhesive coat on each specimen shall be calculated by dividing the difference in weight before and after application of the adhesive by the density of the adhesive. The area of the coated surface of the specimen shall then be divided by that volume, to obtain the coverage in square feet per gallon.

4.4.7 Adhesive strength.

4.4.7.1 Strength before drying (class 1 adhesive only). A one-foot-square section of type I fibrous glass insulation board and a 1-foot-square section of type II fibrous glass insulation board, both conforming to MIL-I-742, shall each be mounted in a vertical position. Two sections of insulation board identical to the vertically mounted boards shall be mounted in a horizontal position, so that the facing of the type I board is down. A prime or underlying coat of adhesive shall then be applied at the same coverage used in 4.4.6 to one side of each of the vertically mounted

MIL-A-3316B

boards and to the lower side of each of the horizontally mounted boards. The adhesive shall be allowed to set for a period ending 5 minutes after the application of the adhesive was started. After the end of that period and prior to the completion of an additional 5-minute period, a 1-foot-square piece of cotton brattice cloth conforming to MIL-C-788 shall be superimposed upon the primed surface of the specimen and hand-troweled smooth, eliminating air pockets, and an overlying or finish coat of the adhesive shall be brushed over the cotton brattice cloth, at the same coverage used in 4.4.6 and the cotton brattice cloth shall be peeled back 1 inch from each of two opposite sides of the specimen. At the end of that additional 5-minute period the cotton brattice cloth shall be allowed to stand without the aid of shoring, pinning, or other mechanical devices and shall be examined for separation from the insulation board.

4.4.7.2 *Drying time and stripping strength.*

4.4.7.2.1 *Class 1 adhesive.* The facing of a 1-foot-square section of type I fibrous glass insulation board conforming to MIL-I-742 shall be cleaned with solvents (e.g., a mixture of equal parts of xylol, MEK and alcohol) to remove possible contaminants. The board, while still wet, shall be wiped with a clean, dry cloth in order to assure removal of the contaminants (drying shall then be thorough). A 12-inch by 6-inch area of the facing of the board shall be coated with the adhesive to an approximate thickness of 1/32 inch, leaving a 12-inch by 6-inch area uncoated. After the adhesive has dried for 5 minutes, a 1-foot-square piece of cotton brattice cloth conforming to MIL-C-788 shall be superimposed on the facing of the board, and pressed and troweled sufficiently to extrude the adhesive through the interstices. The adhered half of the cloth shall then be given a finish coating, which shall be scraped off down to the fabric in order to remove excess adhesive. The adhesive shall be inspected for drying to touch at the end of 48 hours after application. The

facing of the insulation board shall then be carefully sliced away from the fibrous glass felt. The bonded assembly of the fibrous glass facing and cotton brattice cloth shall then be cut to provide five strips 2 inches wide and 12 inches long. A strip-adhesion test of each strip shall be conducted in accordance with ASTM D903. NOTE: The facing of certain batches of fibrous glass insulation board may require additional treatment prior to the application of the adhesive in order to achieve a satisfactory test of adhesive strength; this treatment may be accomplished by priming with a thin brushed-on coat of a small portion of the adhesive which has been thinned sufficiently for this purpose. This coat shall be dried for 72 hours.

4.4.7.2.2 *Classes 2 and 3 adhesives.* Six bare 16-gage cold-rolled steel plates, 5 inches by 10 inches, shall be cleaned with the solvent spray of method 2011 of FED-STD-141, and shall be coated with adhesive to approximately 1/32 inch thickness and allowed to set until tacky, but not longer than 14 minutes. Six 3 inch by 12 inch pieces of bonded fibrous glass insulation conforming to MIL-I-22023 shall then be applied to the coated steel plates and allowed to dry for 24 hours. Three of these specimens shall then be aged at a temperature of 194°F. \pm 5°F. for 24 hours. Within 6 to 24 hours after removal from the oven, all six specimens shall be supported in a horizontal position with the bonded fibrous glass side down and a 300-gram weight attached to the free end of the insulation and suspended for a period of 10 minutes. If failure occurs in the glass insulation a retest shall be made with specimens of insulation selected for higher strength.

4.4.7.3 *Tensile adhesive strength (Class 3 adhesive only).*

4.4.7.3.1 Eighteen steel disks, 4 inches in diameter and 1/2 inch thick, shall be drilled and tapped in the center to receive a 1/2-inch bolt. The tapped holes shall not be drilled

MIL A-3316B

entirely through the disks. Each bolt shall be drilled crosswise at the outer end to receive a steel pin for attaching to the testing machine. (In use, the pin at one end shall be in a plane 90 degrees to the plane of the pin at the other end, to provide freedom in both planes.) The adhesive shall be applied to the surface of the steel disks at an approximate thickness of 1/16 inch and allowed to set for 5 minutes. The coated steel disks shall then be applied to the two sides of 1-inch thick, 4-inch diameter pieces of cork insulation board, conforming to HH-I-525, in such a manner that the cork shall be sandwiched between the steel disks. Both faces of the cork shall, if necessary, have been first sanded smooth, flat and parallel, and the dust removed. The nine specimens thus prepared shall be allowed to dry for 72 hours under a load of 2 psi.

4.4.7.3.2 Three of the specimens shall be pulled to rupture in a pendulum type machine at a normal rate of 2 inches per minute or in a load-cell type machine at a rate of from 0.1 to 0.2 inch per minute. The results shall be averaged. After removal of the cork, the bonded surface of the steel shall be examined for corrosion.

4.4.7.3.3 Three of the specimens shall be submerged in salt water (5 percent NaCl) for 2 hours. Upon removal, they shall immediately be tested as specified in 4.4.7.3.2.

4.4.7.3.4 The remaining three specimens shall be heated in an oven at $200^{\circ}\text{F.} \pm 10^{\circ}\text{F.}$ for 2 hours. The test for each specimen, as specified in 4.4.7.3.2, shall be completed within three minutes after removal from the oven. The bonded surface of the steel shall be examined for corrosion.

4.4.8 *Color (class 1 adhesive).* The specimens prepared for the tests specified in 4.4.7.1 shall be examined to determine the color of the adhesive when dried.

4.4.9 *Flexibility.*

4.4.9.1 *Class 1 adhesive.* For class 1 adhesive, the specimen shall be prepared as specified in 4.4.7.2.1 using the adhered half only. The bonded assembly shall be cut to the size stated in method 2012 of FED-STD-141.

4.4.9.2 *Classes 2 and 3 adhesives.* For classes 2 and 3 adhesives, the specimens shall be prepared on tinplate in accordance with method 2012 of FED-STD-141. A single film of adhesive 0.02 inch \pm 0.002 inch thick shall then be applied to the tinplate panel in accordance with method 2161 or 2162 of FED-STD-141.

4.4.9.3 The coated specimen shall be air dried for 24 hours and shall then be baked for 75 minutes at $217^{\circ}\text{F.} \pm 4^{\circ}\text{F.}$ in a circulating air oven. The coated specimen shall then be conditioned for 1½ to 2 hours at $73^{\circ}\text{F.} \pm 2^{\circ}\text{F.}$ and a relative humidity of 50 ± 5 percent. The flexibility test shall then be conducted with the coated specimen using a 1.4 inch diameter mandrel in accordance with method 6221 of FED-STD-141, except that the magnification and special illumination specified therein for the examination of the coated specimen will not be required. The adhesive film shall be examined for cracks deep enough to expose the substrate.

4.4.10 *Washability (class 1 adhesive only).* The apparatus to be used for the washability test for class 1 adhesives shall be as follows:

- (a) A washability machine with counter and brush conforming to method 6142 of FED-STD-141.
- (b) A glass panel—6 inches by 18 inches conforming to method 2021 of FED-STD-141.
- (c) A film applicator—0.020 inch (0.5 mm.) clearance conforming to method 2162 of FED-STD-141.

MIL-A-3316B

(d) A bar "Bon-Ami", or equal type abrasive soap.

(e) Sample of material to be tested.

4.4.10.1 Procedure. The glass panel shall be prepared as specified in method 2021 of FED-STD-141. A film of material, to be tested, shall be drawn down using the 0.020 inch film applicator. The film shall be drawn down the entire length of the glass panel on the ground side. The draw-down shall be 3.5 inches (9 cm.) or more in width. The panel shall be allowed to dry for 6 days at room temperature (approximately 75°F. \pm 5°F. or 24°C. \pm 3°C.). The glass panel shall be placed on the table of the washability machine. The brush shall be soaked in water for 30 minutes. The brush shall be rubbed vigorously over the bar of "Bon-Ami", or equal, type soap until the bristles are thoroughly saturated with soap. The brush shall be placed into the machine receptacle and shall be aligned on the coated glass panel so that the brush stroke is entirely within the coated area. During the test the water shall be permitted to drop or run into the path of the brush at the rate of about 12 drops per minute, or just sufficient to keep the panel wet. The machine shall be started and run for 1000 double strokes. The brush shall be washed, at once, in water at moderate temperature, and inspected for film within the middle 6 inches of brush travel for definite breaks, wear or detachment of the film down to the glass. A few small pin point areas shall be disregarded.

4.4.11 Paintability (class 1 adhesive only). The adhesive shall be applied to the fibrous glass cloth facing of a 12 inch by 12 inch specimen of fibrous glass insulation board conforming to MIL-I-742 and allowed to set for 10 minutes. A strip of fibrous glass tape conforming to type II, class 1 of MIL-C-20079, shall then be applied to the adhesive-coated specimen. Then a coat of adhesive shall be applied over the tape. The specimen shall be allowed to airdry for 24 hours. A coat of paint conforming the MIL-E-17970

shall be applied to the face of the specimen and allowed to airdry for 24 hours, after which a second coat of enamel shall be applied. The specimen shall be inspected after 24 and 48 hours for signs of bleeding and for discoloration, cracking or crazing of the paint.

4.4.12 Fire resistance.

4.4.12.1 Vertical specimen test. Three strips of fibrous glass tape, 6 inches long and 2 inches wide, conforming to type II, class 1 of MIL-C-20079 shall be coated with the adhesive, so that the tape with coatings on both sides when dried shall have an overall thickness of 0.013 ± 0.003 inch. The coated strips shall be airdried for 24 hours and then placed in a forced-draft oven for 20 hours at 212°F. to 221°F. These specimens shall then be removed from the oven and, after not less than $\frac{1}{4}$ hour, nor more than $\frac{1}{2}$ hour, each in turn shall be suspended vertically from a clamp that covers the upper $\frac{1}{2}$ inch of the strip, in a draft-free location. A Meker burner, having a 30-millimeter diameter grid, and supplied with natural gas of 1100 ± 100 BTU per cubic foot, shall have its flame adjusted so that its outer zone is $1\frac{1}{2}$ inches high and its light blue inner zone is $\frac{1}{16}$ inch high. The burner shall then be placed directly below the specimen in a position such that its grid is one inch below the middle of the lower edge of the specimen. After 5 seconds, the burner shall be extinguished and the length of time that the coating continues to burn after the extinction shall be noted. The results of the three specimens shall be averaged.

4.4.12.2 Horizontal panel test.

4.4.12.2.1 Preparation of specimen, class 1 adhesive. The adhesive shall be applied to the facing of a 30 by 30 by 1-inch specimen of type I fibrous glass insulation board and to one side of a 30 by 30 by 1-inch specimen of type II fibrous glass insulation board conforming to MIL-I-742 (these specimens may be made up from more than one piece).

MIL-A-3316B

Then a 30 by 30-inch piece of cotton brattice cloth conforming to MIL-C-788 shall be superimposed on the primed surface of each of the specimens and hand-troweled smooth, eliminating and removing air pockets, until the adhesive extrudes through the interstices of the cloth. An overlying or finish coat of adhesive shall then be brushed over the cloth. A 36 by 36 by 1/16-inch steel plate, stiffened against sagging, shall be bonded to the opposite side of each specimen. Then each specimen shall be dried to constant weight at a temperature recommended by the adhesive manufacturer as being non-injurious to the particular adhesive under test.

4.4.12.2.2 Preparation of specimen, classes 2 and 3 adhesives. The adhesive shall be applied to the unfaced sides and to the edges of two fibrous glass insulation boards conforming to type I of MIL-I-742 and measuring 15 by 30 by 1 inch each. The two boards shall then be secured by the adhesive to a 36 by 36 by 1/16-inch steel plate, stiffened against sagging, so that the boards are butted together to form a 30-inch square specimen, centered on the steel plate. Then a piece of glass tape, 30 inches long and 2 inches wide, conforming to type II, class 1 of MIL-C-20079, shall be applied over the seam where the two boards are joined, being bonded to the board facings with class 1 adhesive. The specimen shall be allowed to dry for 24 hours. Then two coats of enamel conforming to MIL-E-17970 shall be brushed over the glass cloth facing of the specimen, each coat being allowed to dry for 24 hours.

4.4.12.2.3 Test procedure. Each specimen shall be tested separately, in a room which is free from air currents. The specimen shall be placed in a horizontal position with the insulation downward and with the steel plate supported on the flat surface by a 2 by 2 by 1/4-inch steel angle frame having a 30 by 30-inch clear opening. A gas-air burner of 3/4 to 7/8-inch diameter shall be placed vertically with its top 24 inches below the

center of the lower surface of the specimen. A thermocouple made of 1/8-inch wires and formed into a 3-inch horizontal coil shall be placed 1 inch below the center of the lower surface of the specimen. The wires shall be bare for a distance of 2 inches from the junction. The test shall be conducted by directing a flame from the burner against the center of the lower surface of the specimen for a period of 40 minutes. During the test, the temperature of the thermocouple shall be read and recorded at intervals not exceeding 2 minutes. The flame shall be regulated to give temperature indications conforming to the time-temperature curve shown on figure 1. The flame shall contact the specimen during the entire test period; an exception can be made for the first 5 minutes, if required for proper temperature regulation. At no time during the test shall the flame from the burner contact the specimen at any point which is more than 6 inches from the center of the specimen. The area under the time-temperature curve obtained from the thermocouple readings shall be within 5 percent of the area under the curve of figure 1. During the 40-minute test period, the extent and duration of flaming shall be noted. At the end of the test period, the flame shall be extinguished. The specimen shall then be examined to determine the further extent and duration of flaming, and glowing or smoldering. After the test of either the class 2 or the class 3 adhesive, the insulation board shall be pulled off the steel plate, and the steel plate shall be examined to determine whether separation occurred within the insulation board or between the insulation board and the steel plate.

4.4.13 Puncture resistance. Puncture resistance shall be determined in accordance with the method specified in ASTM D781, except the test specimen shall be placed, with the finished covering surface down, between the clamping plates. Before each test is made, the loose sleeve shall be placed against the base of the puncture point and

the pointer set about 1 inch above the expected reading. The pendulum shall be raised to the horizontal position and released by pushing the latch handle to the left. The reading shall be noted on the proper scale after the pendulum has completed its swing. The scales are graduated in inch-ounces per inch of tear.

4.4.14 Workmanship. The adhesive in each of the one-quart sample units specified in table I and 4.3.2 shall be examined for the presence of grits, lumps and skins.

4.4.15 Unit container content. The unit container shall be weighed and this net weight shall be divided by the weight per gallon of the material, as determined in 4.4.1, to obtain the volumetric content of the container.

4.4.16 Inspection of preparation for delivery. The packaging, packing and marking of the adhesive shall be inspected to determine compliance with the requirements of section 5 of this specification.

5. PREPARATION FOR DELIVERY

5.1 Packaging. Packaging shall be level A or C, as specified (see 6.1).

5.1.1 Level A. The adhesive shall be furnished in 1-gallon cans or 5-gallon pails, as specified (see 6.1).

5.1.1.1 One-gallon cans. One-gallon cans shall conform to type V, class 2 of PPP-C-96. The cans shall be round and shall have plan B exterior coating.

5.1.1.2 Five-gallon pails. Five-gallon pails shall conform to type II, class 3 of PPP-P-704.

5.1.2 Level C. The adhesive shall be packaged to afford adequate protection against deterioration and damage during shipment from the supply source to the first receiving

activity, for immediate use. This packaging may be the supplier's commercial practice when such meets the requirements of this level.

5.2 Packing. Packing shall be level A, B or C, as specified (see 6.1).

5.2.1 Level A.

5.2.1.1 The 1-gallon cans shall be packed in accordance with the overseas shipment requirements of the appendix to PPP-C-96.

5.2.1.2 The five-gallon pails require no packing.

5.2.2 Level B.

5.2.2.1 The 1-gallon cans shall be packed in accordance with the domestic shipment requirements of the appendix to PPP-C-96.

5.2.2.2 The 5-gallon pails require no packing.

5.2.3 Level C. Adhesives shall be packed in containers, at the lowest rates, in a manner which will insure acceptance by common carrier and will afford protection against physical damage during direct shipment from the supply source to the first receiving activity for immediate use. This packing shall conform to the Uniform Freight Classification Rules and Regulations or other carrier regulations, as applicable to the mode of transportation and may be the supplier's commercial practice when such meets the requirements of this level.

5.3 Marking. In addition to any marking required by the contract or order, interior and exterior containers shall be marked in accordance with MIL-STD-129 and the requirements of the Interstate Commerce Commission Regulations when applicable. Interior and exterior containers shall both be marked with the date of manufacture.

MIL-A-3316B**6. NOTES**

6.1 Ordering data. Procurement documents should specify the following:

- (a) Title, number, and date of this specification.
- (b) Class of adhesive required (see 1.2).
- (c) Levels of packaging and packing required (see 5.1 and 5.2).
- (d) Capacity of interior container required (see 5.1).

6.2 Cross-reference of classifications. The classes of this specification corresponding to the types of the previous issues are as follows:

<i>MIL-A-3316B</i>	<i>MIL-A-3316A</i>	<i>MIL-C-3316</i>
Class 1	Type I	_____
Class 1	Type II	Type II
Class 2	Type III	Type III
Class 3	_____	Type I

6.3 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 on Qualified Products List QPL-3316. The attention of the suppliers is called to this requirement, 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 orders for the products covered by this specification. The activity responsible for the qualified products list is the Bureau of Ships, Department of the Navy, Washington, D.C. 20360, 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" (see 6.4).

6.4 Copies of "Provisions Governing Qualification" may be obtained upon application to Commanding Officer, Naval Supply Depot, 5801 Tabor Avenue, Philadelphia, Pennsylvania 19120.

6.5 CHANGES FROM PREVIOUS ISSUE. THE EXTENT OF CHANGES (DELETIONS, ADDITIONS, ETC.) PRECLUDE THE ANNOTATION OF THE INDIVIDUAL CHANGES FROM THE PREVIOUS ISSUE OF THIS DOCUMENT.

Custodians:

Army—MR

Navy—SH

Review activities:

Army—MR

Navy—SH, YD

User activities:

Army—EL, MO

Navy—CG

Preparing activity:

Navy—SH

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MIL-A-3316B

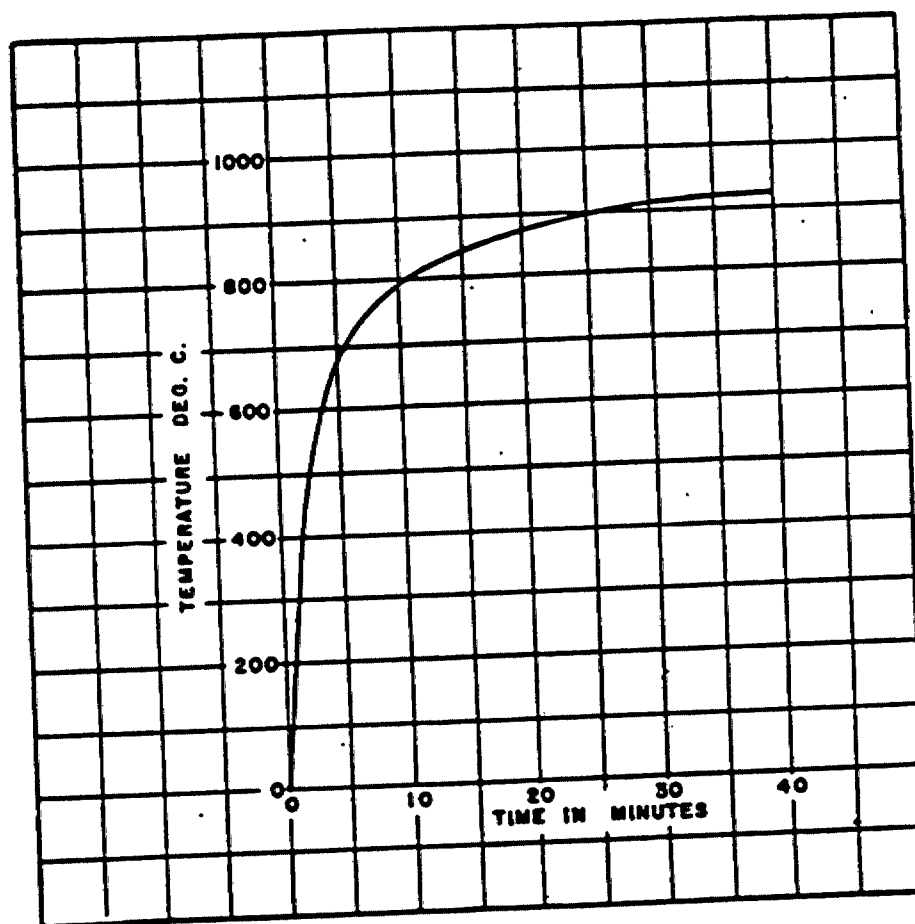


FIGURE 1. Time temperature curve.

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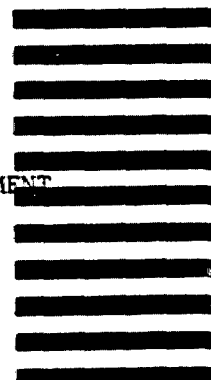
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