INCH-POUND

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20 October 1987
SUPERSEDING
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(See 6.7)

MILITARY SPECIFICATION

ADHESIVES, FIRE-RESISTANT, THERMAL INSULATION

This specification is approved 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 thermal insulations to metal surfaces.

1.2 Classification. The adhesives shall be of the following classes and grades, as specified (see 6.2.1).

Class 1

Grade A - Pigmented white.
Grade B - Pigmented red (sealer coating to identify asbestos-free system).

For bonding fibrous glass cloth to unfaced fibrous glass insulation.
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

Grade A - Pigmented white.

For attaching fibrous glass insulation to metal surfaces.

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.

AMSC N/A FSC 8040

Class 3

Grade A - Pigmented white.

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

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

PPP-C-96 - Cans, Metal, 28 Gage and Lighter.
PPP-P-704 - Pails, Metal: (Shipping, Steel, 1 Through 12 Gallons).

MILITARY

MIL-I-742 - Insulation Board, Thermal, Fibrous Glass.
MIL-C-20079 - Cloth, Glass; Tape, Textile Glass; and Thread, Glass.
MIL-I-22023 - Insulation Felt, Thermal and Sound Absorbing Felt, Fibrous Glass, Flexible.
DOD-E-24607 - Enamel, Interior, Nonflaming (Dry), Chlorinated Alkyd Resin, Semigloss. (Metric)

STANDARDS

FEDERAL

FED-STD-141 - Paint, Varnish, Lacquer and Related Materials; Methods of Inspection, Sampling and Testing.
FED-STD-313 - Material Safety Data Sheets Preparation and the Submission of.
FED-STD-595 - Colors.

MILITARY

MlL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes.
MIL-STD-129 - Marking for Shipment and Storage.

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 LABOR
Code of Federal Regulations, Title 29
Part 1910, Occupational Safety and Health Standards

(Application for copies should be addressed to the Superintendent of Documents, U.S. 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)

C 640 - Standard Specification for Corkboard and Cork Pipe Thermal Insulation.
D 92 - Standard Test Method for Flash and Fire Points by Cleveland Open Cup. (DoD adopted)
D 217 - Standard Test Methods for Cone Penetration of Lubricating Grease. (DoD adopted)
D 562 - Standard Test Method for Consistency of Paints Using the Stormer Viscometer. (DoD adopted)
D 903 - Standard Test Method for Peel or Stripping Strength of Adhesive Bonds. (DoD adopted)
D 1475 - Standard Test Method for Density of Paint, Varnish, Lacquer, and Related Products. (DoD adopted)
D 2196 - Standard Test Methods for Rheological Properties of Non Newtonian Materials by Rotational (Brookfield) Viscometer. (DoD adopted)
D 2486 - Standard Test Method for Scrub Resistance of Interior Latex Flat Wall Paints.
D 3951 - Standard Practice for Commercial Packaging. (DoD adopted)

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

TECHNICAL ASSOCIATION OF THE PULP AND PAPER INDUSTRY (TAPPI)

T 803 - Puncture and Stiffness Test of Container Board.

(Application for copies should be addressed to the Technical Association of the Pulp and Paper Industry, Technology Park/Atlanta, P.O. Box 105113, Atlanta, GA, 30348.)

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. The adhesives 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. 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 fibrous glass cloth, or cause corrosion of bare steel in the adhesion tests or primed steel in service. Adhesives shall not contain mercury or mercury compounds and shall be asbestos free. When specified in the contract or order, a certificate of compliance shall be prepared (see 6.2.2).

3.3 Stability.

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

3.3.2 Freeze-thaw stability. The adhesive shall meet the requirements specified herein (see 4.4.4 through 4.4.13) upon returning to room temperature after subjection to a temperature of 16 degrees Fahrenheit (deg. F) for 16 hours (see 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. Questions pertinent to this effect shall be referred by the contracting activity to the Naval Medical Command (NAVMEDCOM) who will act as an advisor to the contracting activity (see 4.1.2).

3.5 Flash point.

3.5.1 Class 1 adhesive. This material is non-flammable and, as such, does not exhibit a flash point.

3.5.2 Classes 2 and 3 adhesives. The flash point of the adhesives shall be higher than 80 deg. F (see 4.4.4).

3.6 Consistency.

3.6.1 Class 1 adhesive. The consistency of the adhesive at 80 deg. F, after it has been stirred moderately by hand, shall be suitable for both brush and hand application to the surface of faced and unfaced fibrous glass insulation board conforming to MIL-I-742 and to the surface of fibrous glass cloth conforming to type I, class 2 of MIL-C-20079 (see 4.4.5.1). The consistency of the adhesive shall be not less than 50,000 nor more than 150,000 centipoise (cP) units (see 4.4.5.1).

3.6.2 Class 2 adhesive. The consistency of the adhesive shall be not less than 90 nor more than 130 Krebs units (see 4.4.5.2).

3.6.3 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 35 millimeters (mm) (see 4.4.5.3).

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 (see 4.4.6). The finished weight of the covering for each specimen shall be not 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 shall be sufficient to prevent fibrous glass cloth from peeling away more than 1 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 (see 4.4.7.1).

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 (see 4.4.7.2.1).

3.8.2.2 Classes 2 and 3 adhesive. Specimens shall have an adhesive strength of not less than 300 grams (see 4.4.7.2.2).

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 pounds shall result in a retest using cork selected for greater strength.

3.9 Color.

3.9.1 Class 1, grade A adhesive. The adhesive shall be white in color (see 4.4.8).

3.9.2 Class 1, grade B adhesive. The adhesive shall match red no. 31158 of FED-STD-595 (see 4.4.8).

3.10 Flexibility (all classes). The adhesive shall not develop cracks deep enough to expose the substrate (see 4.4.9). Cracks occurring at either end and extending not more than 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 (see 4.4.10).

3.12 Paintability (class 1 adhesive only). The adhesive shall not cause discoloration or bleeding through enamel conforming to DOD-E-24607, shall not cause cracking or crazing of the enamel, and shall be compatible with the enamel (see 4.4.11).

3.13 Fire resistance.

3.13.1 Vertical specimen test (all classes). There shall be no residual flame or continuous burning of any specimen for more than 3 seconds after the test flame is extinguished (see 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 they 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 at the glueline.

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 (see 4.4.13).

3.15 Workmanship. The adhesive shall be free from grit, lumps and skins (see 4.4.14).

3.16 Unit container content. The unit container shall contain not less than the capacity specified in 5.1 (see 4.4.15).

3.17 Material safety data sheet. The contracting activity shall be provided a material safety data sheet (MSDS) at the time of contract award. The MSDS is Form OSHA-20 found in and part of FED-STD-313. The MSDS shall be included with each shipment of the material covered by this specification (see 6.5).

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.

4.1.2 Toxicological formulation. The manufacturer of the compound shall disclose the formulation of his product to the Commander Naval Medical Command (MEDCOM-02) Washington, DC 20372 for approval (see 3.4). The disclosure of proprietary information, which will be held in confidence by the Naval Medical Command, shall include the name, formula, and approximate percentage by weight and volume of each ingredient in the product; the results of any toxicological testing of the product; and such other information as may be needed to permit an accurate appraisal of any toxicity problem associated with the handling, storage, application, use, disposal, or combustion of the 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 4.4.2 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 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.

TABLE I. Quality conformance inspection.

Characteristic	Requirements			Inspection procedures			Sampling data	
	Adhesive class			Adhesive class			Sample units to be tested (4.3.2)	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	Quart
Flash point	3.5.1	3.5.2	3.5.2	----	4.4.4	4.4.4	No. 2	
Consistency	3.6.1	3.6.2	3.6.3	4.4.5.1	4.4.5.2	4.4.5.3	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	
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	3.13	3.13	4.4.12	4.4.12	4.4.12	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 4.3.2.3	Filled unit container
Packaging	5.1	5.1	5.1	4.5	4.5	4.5	See 5.1	
Marking of unit container	5.3	5.3	5.3	4.5	4.5	4.5	4.3.2.3	
Packing	5.2	5.2	5.2	4.5	4.5	4.5	5.2	Filled shipping container
Marking of shipping container	5.3	5.3	5.3	4.5	4.5	4.5	4.3.2.3	

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 1-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 1-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 in these 1-quart sample units shall be as specified in table I. Should any 1-quart sample unit fail in any test, the batch shall be rejected.

4.3.2.3 Sampling for examination of filled containers. A random selection of filled containers shall be inspected in accordance with MIL-STD-105 with an Inspection Level of I with an AQL of 2.5. Examination to be as specified in 4.4.15.

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. A no. 2 one-quart container shall be thoroughly mixed. The weight per gallon of its contents shall be determined in accordance with ASTM D 1475 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 1-quart containers of the sample shall be subjected to a temperature of 16 +/- 2 deg. F for a period of 16 hours, shall then be allowed to return to room temperature, and shall 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 +/- 10 deg. F and at a relative humidity of 50 +/- 20 percent.

4.4.4 Flash point. The flash point of classes 2 and 3 adhesive shall be determined in accordance with ASTM D 92. Throughout the test the adhesive shall be stirred sufficiently to prevent skimming or surface segregation.

4.4.5 Consistency.

4.4.5.1 Class 1 adhesive. The consistency of the adhesive shall be determined through the use of a Brookfield viscometer in accordance with ASTM D2196. The viscometer shall be supplied with a helipath attachment and T-bar spindles (sizes A thru F) or disc type spindles. The adhesive sample shall be penetrated with the spindle to 1/4 inch. The viscometer shall then be turned on to a speed of 2.5 revolutions per minute (r/min) to allow the spindle to rotate. The helipath attachment shall then be turned on and dial readings of each revolution through the downward and upward strokes shall be recorded. The helipath shall then be turned off and the spindle speed increased to 5 r/min to allow the spindle to rotate. The helipath attachment shall be turned on again and dial readings of each revolution through the downward and upward strokes shall again be recorded. Dial readings shall be multiplied by the appropriate factor to obtain the viscosity readings in cP. A minimum of 10 viscosity readings shall then be averaged to obtain the adhesive viscosity.

4.4.5.2 Class 2 adhesive. The consistency of the adhesive shall be determined in accordance with ASTM D 562.

4.4.5.3 Class 3 adhesive.

4.4.5.3.1 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.

4.4.5.3.2 Procedure. The open cup portion of the grease-worker shall be completely filled with the well-mixed sample at a temperature of 77 +/- 1 deg. A straight edge 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 recorded. 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 finish (class 1 adhesive only). A prime or underlying coat of adhesive shall be applied to the facing of a 1-square foot section of fibrous glass insulation board, conforming to type I of MIL-I-742. A 1-square foot piece of fibrous cloth conforming to type I, class 2 of MIL-C-20079 shall then be immediately superimposed upon the primed surface of each board and handtroweled 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 in 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 1-square foot section of type I fibrous glass insulation board and a 1-square foot 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 supplied at the same coverage used in 4.4.6 to one side of each of the vertically mounted 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-square foot piece of fibrous glass cloth conforming to type I, class 2 of MIL-C-20079 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 fibrous glass cloth, at the same coverage used in 4.4.6, and the fibrous glass 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 fibrous glass 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-square foot section of type I fibrous glass insulation board conforming to MIL-I-742 shall be cleaned with solvents (for example, 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- 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- by 6-inch area uncoated. After the adhesive has dried for 5 minutes, a 1-square foot piece of fibrous glass cloth conforming to type I, class 2 of MIL-C-20079 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 adhesive shall be visually inspected for dryness. If the adhesive is not dry, an additional 12 hours drying time shall be allowed. 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 fibrous glass 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 D 903. 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 test of adhesive strength; this treatment shall 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-gauge cold-rolled steel plates, 5 by 10 inches, shall be cleaned with the solvent spray of method 2011.2 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- 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 +/- 5 deg. 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 Preparation of specimens. Eighteen steel disks, 4 inches in diameter by 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 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. (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 by 4-inch diameter pieces of cork insulation board, conforming to ASTM C 640, 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 pounds per square inch (lb/in^2).

4.4.7.3.2 Procedure. 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 Salt water test procedure. 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 Oven test procedure. The remaining three specimens shall be heated in an oven at 2OO +/- 10 deg. F for 2 hours. The test for each specimen, as specified in 4.4.7.3.2, shall be completed within 3 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. The adhesive color shall meet the requirements of 3.9.

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.

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 2012.2 of FED-STD-141. A single film of adhesive 0.02 +/- 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 Procedure. The coated specimen shall be air dried for 24 hours and then baked for 75 minutes at 217 +/- 4 deg. F in a circulating air oven. The coated specimen shall then be conditioned for 1-1/2 to 2 hours at 73 +/- 2 deg. F at 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 ASTM D 2486.
(b) A glass panel, 6 by 18 inches, conforming to method 2021 of FED-STD-141.
(c) A film applicator, with a 0.020 inch clearance, conforming to method 2162 of FED-STD-141.
(d) A bar of "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 or more in width. The panel shall be allowed to dry for 6 days at room temperature (approximately 75 +/- 5 deg. F). 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 panel 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 pinpoint 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- by 12-inch specimen of fibrous glass insulation board conforming to type I of 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 air dry for 24 hours. A coat of paint conforming to DOD-E-24607 shall be applied to the face of the specimen and allowed to air dry 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 I of MIL-C-20079 shall be coated on both sides with the adhesive, then drawn through two polished metal rods (1/2- to 1-inch diameter). The bars shall be parallel so that the tape with coating on both sides when dried shall have an overall thickness of 0.013 inch. The coated strips shall be air-dried for 24 hours and then placed in a forced-draft oven for 20 hours at 212 to 221 deg.F. These specimens shall then be removed from the oven and, after not less than 1/4 hour, nor more than 1/2 hour, each in turn shall be suspended vertically from a clamp that covers the upper 1/2 inch of the strip, in a draft-free location. A Meker burner, having a 30-mm diameter grid, and supplied with natural gas of 1100 +/- 100 British thermal units (Btu) per cubic foot, shall have its flame adjusted so that its outer zone is 1-1/2 inches high and its light blue inner zone is 1/16 inch high. The temperature of the flame shall be measured using a type R or S thermocouple at a point 1-1/4 +/- 1/32 inches above the center of the grid and shall be between 1300 and 1900 deg.F. Flame adjustment shall be performed in a darkened area and shall utilize a black object behind the flame in order to enhance observation of the flame height. The burner shall then be placed directly below the specimen in a position such that its grid is 1 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). Then a 30- by 30-inch piece of fibrous glass cloth conforming to type I, class 2 of MIL-C-20079 shall be superimposed on the primed surface of each of the specimens and handtroweled 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-square inch specimen, centered on the steel plate. 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. Two coats of enamel conforming to DOD-E-24607 shall be brushed over the glass cloth facing of the specimen, each cost 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 1/2-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 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 may 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 on 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 TAPPI T 803, 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.

4.4.14 Workmanship. The adhesive in each of the 1-quart sample units specified in table I and 4.3.2 shall be examined for the presence of grit, 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.

4.5 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.)

5.1 Packaging. Packaging shall be level A or C, as specified (see 6.2.1).

5.1.1 Level] A. The adhesive shall be furnished in 1-gallon cans or 5-gallon pails, as specified (see 6.2.1).

5.1.1.1 One-gallon cans. One-gallon cans shall conform to type V, class 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. Packaging may conform to the contractor’s normal retail procedure when such meets the requirements of this level.

5.2 Packing. Packing shall be level A, B, C, or commercial, as specified (see 6.2.1).

5.2.1 Level A.

5.2.1.1 One-gallon cans. 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 Five-gallon pails. The 5-gallon pails require no packing.

5.2.2 Level B.

5.2.2.1 One-gallon cans. 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 Five-gallon pails. The 5-gallon pails require no packing.

5.2.3 Level C. Adhesives packaged as specified (see 6.2.1) shall be packed in containers acceptable to the common carrier which will ensure safe delivery at the destination in a satisfactory condition at the lowest applicable rate. Containers or method of shipment shall comply with Uniform Freight or National Motor Freight Classification rules or regulations or other carrier rules and regulations as applicable to the mode of transportation.

5.2.4 Commercial. When specified (see 6.2.1), commercial packing shall be in accordance with ASTM D 3951.

5.3 Marking. In addition to any marking required by the contract or order (see 6.2.1), interior and exterior containers and palletized or containerized loads shall be marked in accordance with MIL-STD-129 and the requirements of the Code of Federal Regulations, Title 29, Part 1910 when applicable. Interior and exterior containers shall both be marked with the date of manufacture.

5.3.1 Special marking. All classes and grades containers shall include the following marking:

"DOES NOT CONTAIN MERCURY OR MERCURY COMPOUNDS
ASBESTOS FREE
DO NOT ADD WATER OR ANY THINNING AGENTS"

In addition, class 1 grade B containers shall also include the following:

"FOR USE WITH ASBESTOS FREE THERMAL INSULATION ONLY"

6. NOTES

6.1 Intended use. The adhesives covered by this specification are intended for use in securing cloth and tape to thermal insulations and for securing thermal insulations to metal surfaces.

6.2 Ordering data.

6.2.1 Acquisition requirements. Acquisition documents should specify the following:

(a) Title, number, and date of this specification.
(b) Class and grade of adhesive required (see 1.2).
(c) Levels of packaging and packing required (see 5.1, 5.2 and 5.2.3).
(d) Capacity of interior container required (5.1.1).
(e) When palletized or containerized loads are required (see 5.2.4).
(f) When special marking is required (see 5.3).

6.2.2 Data requirements. When this specification is used in an acquisition and data are required to be delivered, the data requirements identified below shall be developed as specified by an approved Data Item Description (DD Form 1664) and delivered in accordance with the approved Contract Data Requirements List (CDRL), incorporated into the contract. When the provisions of DoD FAR Supplement, Part 27, Sub-Part 27.47S-l (DD Form 1423) are invoked and the DD Form 1423 is not used, the data specified below shall be delivered by the contractor in accordance with the contract

or purchase order requirements. Deliverable data required by this specification are cited in the following paragraph.

Paragraph no.	Data requirement title	Applicable DID no.	Option
3.2	Certificate of compliance	DI-E-2121	----

(Data item descriptions related to this specification, and identified in section 6 will be approved and listed as such in DoD 5010.12-L., AMSDL. Copies of data item descriptions required by the contractors in connection with specific acquisition functions should be obtained from the Naval Publications and Forms Center or as directed by the contracting officer.)

6.2.2.1 The data requirements of 6.2.2 and any task in sections 3, 4, or 5 of this specification required to be performed to meet a data requirement may be waived by the contracting acquisition activity upon certification by the offeror that identical data were submitted by the offeror and accepted by the Government under a previous contract for identical item acquired to this specification. This does not apply to specific data which may be required for each contract regardless of whether an identical item has been supplied previously (for example, test reports).

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-3316 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).

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

MIL-A-3316C and MIL-A-3316B	MIL-A-3316A	MIL-C-3316
Class 1	Type I	----
Class 1	Type II	Type II
Class 2	Type III	Type III
Class 3	----	Type I

6.5 Material safety data sheets. Contracting officers will identify those activities requiring copies of completed Material Safety Data Sheets (MSDS) prepared in accordance with FED-STD-313. The pertinent Government mailing addresses for submission of data are listed in appendix B of FED-STD-313. In order to obtain the MSDS, FAR clause 52.223-3 must be in the contract.

6.6 Subject term (key word) listing.

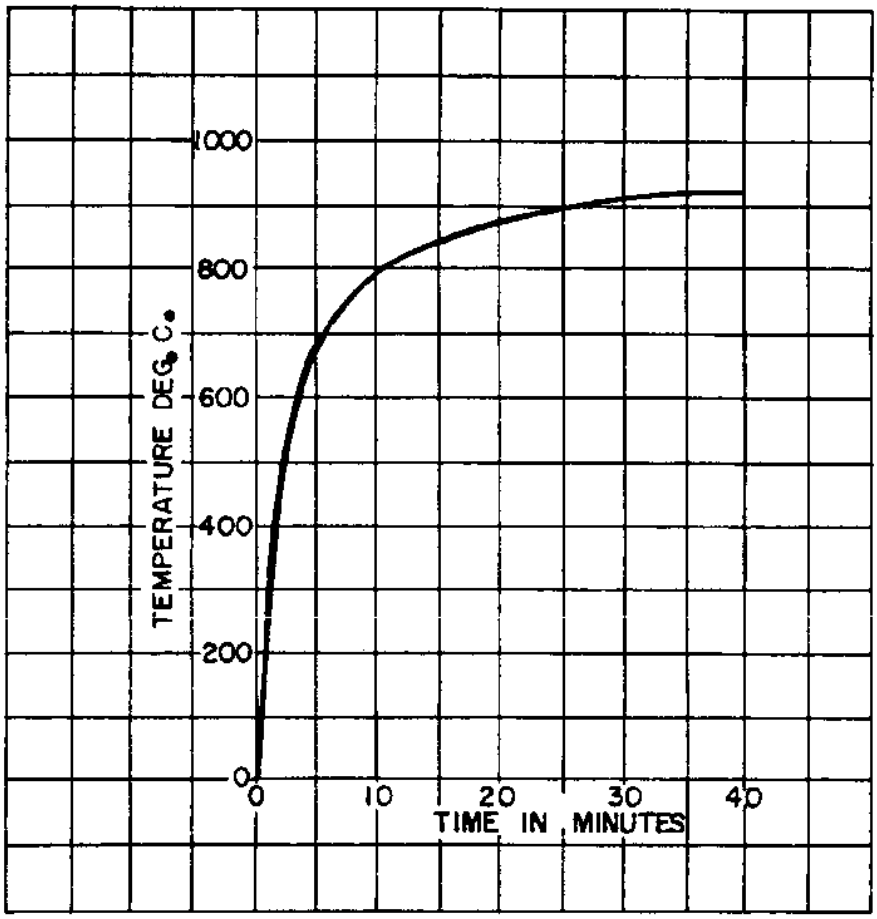
Bonding
Fibrous glass cloth
Fibrous glass insulation

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 - MR
Navy - SH

User activities:
Navy - AS, OS, YD, CG

Preparing activity:
Navy - SH
(Project 8040-0462)



SH 131921

FIGURE 1. Time temperature curve.

INCH-POUND

MIL-A-3316C
INT. AMENDMENT 1 (SH)
14 June 1988

MILITARY SPECIFICATION

ADHESIVES, FIRE-RESISTANT,
THERMAL INSULATION

This interim amendment is approved for use within the Naval Sea Systems Command, with MIL-A-3316 dated 20 October 1987.

PAGE 4

3.4, second sentence: Delete "(See 4.1.2)" and substitute "(see 4.4.15)".

PAGE 5

3.5.1, first sentence: Delete and substitute: "The flash point of the adhesive shall be higher than llO deg. F (see 4.4.4).

PAGE 7

3.16: Delete "(see 4.4.15)" and substitute "(see 4.4.16)".

3.17: Delete and substitute:

"3.17 Material safety data sheet (MSDS). The contracting activity shall be provided a material safety data sheet at the time of contract award. The MSDS shall be provided in accordance with the requirements of FED-STD-313 and 29 CFR 1910.1200, Hazard Communication Standard. When FED-STD-313 is at variance with the CFR, 29 CFR 1910.1200 shall take precedence. FED-STD-313 shall be modified and supplemented accordingly. The MSDS shall be included with each shipment of the material covered by this specification (see 6.S)."

4.1.2: Delete.

4.2, second sentence: Delete "4.4.14 and substitute "4.4.15".

PAGE 8

Table I, Flash point, under Inspection procedures for Adhesive class 1 column, add: "4.4.4" and Unit container content, under Inspection procedures for adhesive class 1, 2, and 3 columns, delete "4.4.15" and add "4.4.16".

AMSC N/A FSC 8040
DISTRIBUTION STATEMENT A Approved for public release; distribution unlimited

PAGE 9

4.3.2.3, second sentence: Delete "4.4.15" and substitute "4.4.16".

4.4.1, second sentence: Delete "4.4.15" and substitute "4.4.16".

PAGE 10

4.4.4, first sentence: Add "1," after "classes".

PAGE 16

4.4.15: Renumber to "4,4,16".

Add new paragraph 4.4.15:

"4.4.15 Toxicological formulation. To determine conformance to the requirements of 3.4, the manufacturer of the compound shall disclose the formulation of his product to the Commander, Naval Medical Command (MEDCOM-02) Washington, DC 20372 for approval. The disclosure of proprietary information, which will be held in confidence by the Naval Medical Command, shall include the name, formula, and approximate percentage by weight, and volume of each ingredient in the product; the results of any toxicological testing of the product: and such other information as may be needed to permit an accurate appraisal of any toxicity problem associated with the handling, storage, application, use, disposal, or combustion of the material."

PAGE 19

6.5: Delete and substitute:

"6.5 Material safety data sheet (MSDS). Contracting officers shall identify those activities requiring copies of MSDSs. Additional required Government information is contained in FED-STD-313. In order to obtain the MSDS, FAR clause 52.223-3 must be in the contract."

Custodians:
Army - MR
Navy - SH

Preparing activity:
Navy - SH
(Project 8040-N139)

User activities:
Navy - AS, OS, YD, CG

INCH-POUND

MIL-A-3316C
AMENDMENT 2
23 August 1990

SUPERSEDING
INT. AMENDMENT 1
14 June 1988

MILITARY SPECIFICATION

ADHESIVES, FIRE-RESISTANT, THERMAL INSULATION

This amendment forms a part of MIL-A-3316C, dated 20 October 1987, and is approved for use by all Departments and Agencies of the Department of Defense.

PAGE 4

3.4, second sentence: Delete "(See 4.1.2)" and substitute "(see 4.4.15)".

PAGE 5

3.5.1, first sentence: Delete and substitute: "The flash point of the adhesive shall be higher than 110 deg. F (see 4.4.4).

PAGE 7

3.16: Delete "(see 4.4.15)" and substitute "(see 4.4.16)".

3.17: Delete and substitute:

"3.17 Material safety data sheet (MSDS). The contracting activity shall be provided a material safety data sheet at the time of contract award. The MSDS shall be provided in accordance with the requirements of FED-STD-313 and 29 CFR 1910.1200, Hazard Communication Standard. When FED-STD-313 is at variance with the CFR, 29 CFR 1910.1200 shall take precedence. FED-STD-313 shall be modified and supplemented accordingly. The MSDS shall be included with each shipment of the material covered by this specification (see 6.5)."

4.1.2: Delete.

4.2, second sentence: Delete "4.4.14 and substitute "4.4.15".

AMSC N/A FSC 8040

PAGE 8

Table I, Flash point, under Inspection procedures for Adhesive class 1 column, add: "4.4.4" and Unit container content, under Inspection procedures for adhesive class 1, 2, and 3 columns, delete "4.4.15" and add "4.4.16".

PAGE 9

4.3.2.3, second sentence: Delete "4.4.15" and substitute "4.4.16".

4.4.1, second sentence: Delete "4.4.15" and substitute "4.4.16".

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PAGE 18

* 6.2.2.1: Delete.

PAGE 19

6.5: Delete and substitute:

"6.5 Material safety data sheet (MSDS). Contracting officers shall identify those activities requiring copies of MSDSs. Additional required Government information is contained in FED-STD-313. In order to obtain the MSDS, FAR clause 52.223-3 must be in the contract."

The margins of this amendment are marked with an asterisk to indicate where changes (additions, modifications, corrections, deletions) from the previous amendment were made. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document base on the entire content irrespective of the marginal notations and relationship to the last previous amendment.

Custodians:
Army - MR
Navy - SH

User activities:
Navy - AS, OS, YD, CG

Preparing activity:
Navy - SH
(Project 8040-0499)