MIL-A-9117D
19 Apr 1971
SUPERSEDING
MIL-A-9117C
5 Feb 1965

MILITARY SPECIFICATION

ADHESIVE: SEALING, FOR AROMATIC FUEL CELLS AND GENERAL REPAIR

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

1. SCOPE

1.1 Scope. This specification covers a one-part synthetic elastomeric adhesive for fuel cell repair work and for other general repair work where resistance to aromatic fuel is required.

1.2 Classification. This specification covers one grade and two classes of synthetic elastomeric adhesive:

Class G - For use under normal circumstances.

Class L - For use where Air Pollution Regulations are enforced.

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 this specification to the extent specified herein:

SPECIFICATIONS

Federal

TT-M-261	Methyl Ethyl Ketone, Technical
TT-S-735	Standard Test Fluids; Hydrocarbon
PPP-C-96	Cans, Metal, 28 Gage and Lighter
PPP-G-460	Glass Containers, One Gallon Capacity and Smaller for Other than Medical Products, Packaging and Packing of

STANDARDS

Military

MIL-STD-129	Marking for Shipment and Storage

SPECIFICATION BULLETINS

USAF 539 Standard Elastomer Stocks

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

2.2 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

D 2267 Aromatics in Light Naphthas and Aviation Gasoline by Gas Chromatography

(Copies may be obtained from the American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pa 19103.)

UNIFORM CLASSIFICATION COMMITTEE

Uniform Freight Classification Rules

(Application for copies should be addressed to the Uniform Classification Committee, 202 Chicago Union Station, Chicago, Ill 60606.)

NATIONAL MOTOR FREIGHT TARIFF ASSOCIATION, INC.

National Motor Freight Classification

(Application for copies should be addressed to American Trucking Association, Attn: Tariff Order Section, 1616 P Street N.W., Washington, D. C. 20036.)

3. REQUIREMENTS

3.1 Material. The material shall be a synthetic elastomeric adhesive.

3.2 Aromatic fuel resistance. The strength of the adhesive bond shall be a minimum of 6 pounds when specimens are prepared and tested in accordance with 4.5.2 and 4.5.4.

3.3 Bond. The strength of the adhesive bond shall be as shown in table I, when tested in accordance with 4.5.5.

TABLE I. Bond strength of unaged adhesive

Length of cure	Adhesion (lbs.)
4 hours	5.0 minimum
24 hours	10.0 minimum

3.4 Heat resistance. The faying surfaces of a bonded 1-inch lap joint of MIL-H stock material (see 4.5.1) shall not slip when subjected to a continuous dead weight shear load of 2 pounds for 24 hours at 158° ± 2° F, when prepared and tested in accordance with 4.5.6.

3.5 Storage stability. The adhesive, when aged (see 4.5.7), shall show no signs of gelling, or deterioration such as lumping, coagulation, or separation of adhesive components, and shall be readily brushable.

3.5.1 Bond strength after storage. The strength of the adhesive bond after a 24-hour cure of the aged adhesive (see 4.5.7) shall be at least 80 percent of the strength obtained for the 24-hour cure on the unaged adhesive.

3.6 Toxicity. The manufacturer shall certify that the adhesive contains no substance of known toxicity under normal conditions of usage.

3.7 Composition.

3.7.1 Class G. The adhesive shall be formulated to meet the composition requirements of table II.

3.7.2 Class L. The adhesive shall be formulated to meet the composition requirements of table II, except the volatile portion shall be as specified in 3.8.

TABLE II. Composition

Nonvolatile content	Minimum	Maximum
Class G	24	30
Class L	24	30

3.8 Volatile content class L. The volatile content of the class L adhesive shall be a non-photochemically reactive solvent mixture as defined in 3.8.1.

3.8.1 A non-photochemically reactive solvent is any solvent with an aggregate of less than 20 percent of its total volume composed of the chemical compounds classified below or which does not exceed any of the following individual percentage composition limitations, referred to the total volume of solvent:

3.8.1.1 A combination of hydrocarbons, alcohols, aldehydes, esters, ethers, or ketones having an olefinic or cycloolefinic type unsaturation: 5 percent.

3.8.1.2 A combination of aromatic compounds with eight or more carbon atoms to the molecule except ethylbenzene: 8 percent.

3.8.1.3 A combination of ethylbenzene, ketones having branched hydrocarbon structures, trichloroethylene or toluene. 20 percent.

4. QUALITY ASSURANCE PROVISIONS

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 in the contract or order, the supplier 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.

4.2 Classification of inspection. The examination and testing of the adhesive are classified as quality conformance inspection.

4.3 Quality conformance inspection.

4.3.1 Sampling. Two pint containers, representative of each lot of adhesive or order, shall be selected and subjected to the tests of 4.5. Only one pint container is necessary if storage stability tests are not required.

4.3.1.1 Lot. Unless otherwise specified, a lot shall consist of all adhesive manufactured at one time from one batch, forming part of one contract or order, and submitted for inspection at the same time and place.

4.4 Standard conditions. Standard conditions during the make-up of samples and during air cure shall be 77° ± 2°F, and 50 ± 5 percent relative humidity.

4.5 Test procedures.

4.5.1 Test specimens. The standard NBR-H stock (see 6.4) used for tests contained herein shall conform to USAF Specification Bulletin 539.

4.5.2 Preparation of specimens. The standard NBR-H stock sheet shall be cut into 1-1/2 inch by 6 inch strips and washed with toluene. Buffing of the strips will not be allowed. After allowing the washed strips to dry for 5 to 45 minutes, two coats of adhesive shall be applied allowing 5 to 15 minutes to elapse between coats. The adhesive shall be allowed to air cure for approximately 1 hour. The coated surfaces shall then be reactivated by applying methyl ethyl ketone with a cotton cloth until tacky. The reactivated surfaces shall be placed together within 1 minute. After the strips are joined, they shall be rolled with a 4.5-(± 0.1) pound hard-surface roller at a rate of 12 inches per minute. Using only the weight of the roller, it shall be passed once in each direction over the surface. After the curing periods specified in table I, 1 inch by 6 inch strips shall then be cut from the center portions of the 1-1/2 inch by 6 inch strips and tested as specified.

4.5.3 Strip-back test. Strips to be tested shall be separated by hand at one end of the strip specimen for a distance sufficient to permit the attachment of the jaws of the testing machine. The free ends of the strips shall then be clamped in the jaws of a pendulum type test machine and pulled apart at an angle of 180 degrees to each other at a jaw separation rate of 2 inches per minute. The first and last inch of the bonded section shall not be used in the test. The average constant peak load of each specimen shall be recorded. If any sample tested falls below the minimum requirement the adhesive shall be rejected.

4.5.4 Aromatic fuel resistance test. The bond specimen shall be air cured for 24 hours at a temperature of 77° ± 2°F and then immersed in fuel conforming to type III of TT-S-735. The ratio of the fuel to the bonded material shall be approximately 300 parts of fuel to the bonded material by weight. The strip-back test (4.5.3) shall be conducted after 7 days' immersion, and shall be conducted immediately after removal from the fuel. The average of three specimens shall be reported. If any sample tested falls below the minimum requirement the adhesive shall be rejected.

4.5.5 Bond test. The bond shall be cured for 4 to 24 hours at a temperature of 77° ± 2°F. Strip-back tests (4.5.3) shall be conducted on three specimens for each run and the average reported.

4.5.6 Heat resistance test. A lap joint, using strips of the standard stock, shall be made in such a way that the area bonded as 1 square inch. Two coats of adhesive shall be applied after the material has been washed with toluene. The adhesive shall be air cured for approximately 1 hour prior to reactivation and shall be reactivated by applying methyl ethyl ketone with a cotton cloth until tacky. The bond shall be made immediately after reactivation and air

cured for 16 hours at room temperature. It shall then be placed in a dry-air oven and aged for 24 hours at a temperature of 150° ± 2°F. The bond shall then be subjected to a continuous dead-weight shear load of 2 pounds while maintained at 158° ± 2°F for 24 hours. The specimen shall not be removed from the oven at any time during the test. Three lap joints shall be tested. If any sample tested falls below the minimum requirement the adhesive shall be rejected.

4.5.7 Storage stability test. One unopened container or adhesive shall be placed in an oven, maintained at a temperature of 120° ± 2°F, and allowed to age 4 weeks. The container shall then be cooled 4 hours at standard conditions (see 4.4) and examined. Unless otherwise specified by the procuring activity, the storage stability test shall be required only on the first order of a new supplier of adhesive (see 6.2).

4.5.8 Nonvolatile content. A weighing bottle (approximately 2.25 inches inside diameter and 1.25 inches deep) shall be heated for 1 hour at 100° ± 5°C (212° ± 9°F) then cooled in a desiccator, and weighed. All weighings shall be to the nearest one-hundredth g. Approximately 20 g. of the sample shall be placed in the prepared weighing bottle, the bottle immediately covered, and weighed. The cover shall be removed, and the weighing bottle placed on a steam bath until most of the solvent has evaporated. (Caution: Care should be taken to remove as much of the solvent as is practicable by this method in order to eliminate any fire hazard which might otherwise exist when the material is subjected to the subsequent drying operation.) The weighing bottle and contents shall then be placed in an oven at 100° ± 5°C (212° ± 9°F) heated for 5 hours, and the original cover replaced. The weighing bottle contents and cover shall then be cooled in a desiccator and weighed. The heating and weighing procedure shall be continued by heating periods of 1/2 hour at 100° ± 5°C (212° ± 9°F) until the loss in weight is less than 0.2 g. The percentage of nonvolatile matter shall be calculated by the following equation to determine compliance with the requirements in Table II.

$$\text{Percent of nonvolatile matter} = \frac{a}{b} \times 100$$

where:

a = weight of sample after heating
b = weight of sample for determination

4.5.9 Non-photochemically reactive solvents. The photochemically reactive solvent of the nonphotochemically reactive volatile composition shall be determined using a gas chromatograph or other suitable device in accordance with ASTM D 2267.

4.6 Rejection. Failure to conform to this specification shall be cause for rejection of the lot.

4.7 Packaging, packing, and marking. Preparation for delivery shall be examined for conformance to section 5.

5. PREPARATION FOR DELIVERY

5.1 Packaging. Packaging shall be level A or C, as specified (see 6.2).

5.1.1 Level A.

5.1.1.1 Unit packaging. The adhesive in the quantity specified shall be packaged in glass jars or cans, as specified (see 6.2).

5.1.1.1.1 Glass Jars. The glass jars shall be round, squat type with the mouth opening wide enough to permit easy removal of all contents with a spatula. Unless otherwise specified, jars shall be closed with metal or plastic continuous thread screw caps. Caps will contain a lining material which shall be resilient or backed by a resilient material. The lining material shall be compatible with the contents of the jar. After sealing of the container(s), cap(s) shall have such tension applied as to seal the jars against leakage and loosening during handling, shipment, and storage.

5.1.1.1.2 Cans. The cans shall be 1 pint or 1 quart capacity, as specified (see 6.2) conforming to type V, round, class 2, plans A or B of PPP-C-96 and the interior packaging shall be in accordance with the appendix to PPP-C-96.

5.1.2 Level C.

5.1.2.1 Unit packaging. The adhesive shall be packaged in unit capacity containers in accordance with the suppliers commercial practice.

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

5.2.1 Level A.

5.2.1.1. Glass jars. Adhesive, packaged as specified in 5.1.1.1.1, shall be packed in accordance with PPP-C-460.

5.2.1.2 Cans. Adhesive, packaged as specified in 5.1.1.1.2, shall be packed in accordance with the overseas shipping requirements of the appendix to PPP-C-96.

5.2.1.3 Gross weight. Gross weight of wood and wood-cleated boxes shall not exceed 200 pounds, of fiberboard boxes, 70 pounds. Box closure and strapping shall be in accordance with the applicable specification or appendix thereto.

5.2.2 Level B.

5.2.2.1 Glass jars. Adhesive, packaged as specified in 5.1.1.1.1, shall be packed in accordance with PPP-G-460.

5.2.2.2 Cans. Adhesive, packaged as specified in 5.1.1.1.2, shall be packed in accordance with the domestic shipment requirements of the appendix to PPP-C-96.

5.2.3 Level C.

5.2.3.1 Adhesive, packaged as specified in 5.1.2.1, shall be packed in exterior containers of the type, size, and kind commonly used for the purpose, in a manner that will ensure acceptance by common carrier and safe delivery at destination. Shipping containers shall comply with Uniform Freight Classification Rules, or regulations of the National Motor Freight Classification as applicable.

5.3 Marking of shipments. Interior packages and exterior shipping containers shall be marked in accordance with MIL-STD-129, and the precautionary marking as follows shall appear on two opposite sides of each exterior container whenever practicable, depending on the size of the carton:

STORE IN A COOL PLACE

Each interior package shall show instructions for application and the use of a suitable thinner, and bear the following precautionary label:

WARNING
HARMFUL IF SWALLOWED OR ABSORBED THROUGH SKIN. AVOID CONTACT WITH EYES, SKIN AND CLOTHING. WASH THOROUGHLY AFTER HANDLING.

6. NOTES

6.1 Intended use. The synthetic adhesive is intended for use in fuel cell repair work, or for other general repair work where aromatic fuel resistance is necessary.

6.2 Solvent. The solvent for the adhesive should be methyl ethyl ketone conforming to TT-M-261 for Class G. For Class L, the solvent should be such that the final adhesive formulation will have a solvent content which is nonphotochemically reactive as defined in 3.6.

6.3 Ordering data. Procurement documents should specify:

(a) Class as applicable (Class G for General Use, Class L for nonphotochemically reactive).
(b) Title, number, and date of this specification.
(c) Type and size of the unit container desired (see 5.1.1.1).
(d) If storage test is required (see 4.5.7).
(e) Quantity (see 5.1.1.1).
(f) Applicable levels of packaging and packing (see 5.1 and 5.2).

6.4 A suggested source for the MIL-H stock is: Precision Rubber Products, Dayton, Ohio (see 4.5.1).

6.5 Marginal indicia. Margins of this specification are not marked with asterisks to indicate where changes (additions, modifications, corrections, deletions) from the previous issue were made, due to the extensiveness of the changes.

CUSTODIANS:
Air Force - 84
Army - MR
Navy - AS

REVIEWER ACTIVITIES:
Army - MR, 8, MD
Navy - AS

USER ACTIVITIES:
Air Force - 11
Army -
Navy - SH, MC

PREPARING ACTIVITY
Air Force - 84
PROJECT 8040-0275

SPECIFICATION ANALYSIS SHEET

Form Approved Budget Bureau No. 119-R004

INSTRUCTIONS

This sheet is to be filled out by personnel either Government or contractor, involved in the use of the specification in procurement of products for ultimate use by the Department of Defense. This sheet is provided for obtaining information on the use of this specification which will insure that suitable products can be procured with a minimum amount of delay and at the least cost. Comments and the return of this form will be appreciated. Fold on lines on reverse side, staple in corner, and send to preparing activity.

SPECIFICATION

MIL-A-9117D; Adhesive, Sealing, for Aromatic Fuel Cells and General Repair

ORGANIZATION

CITY AND STATE

CONTRACT NO

QUANTITY OF ITEMS PROCURED

DOLLAR AMOUNT

$

MATERIAL PROCURED UNDER A

☐ DIRECT GOVERNMENT CONTRACT ☐ SUBCONTRACT

1 HAS ANY PART OF THE SPECIFICATION CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE?

A GIVE PARAGRAPH NUMBER AND WORDING

B RECOMMENDATIONS FOR CORRECTING THE DEFICIENCIES

2 COMMENTS ON ANY SPECIFICATION REQUIREMENT CONSIDERED TOO RIGID

3 IS THE SPECIFICATION RESTRICTIVE?

☐ YES ☐ NO IF "YES" IN WHAT WAY?

4 REMARKS *(Attach any pertinent data which may be of use in improving this specification. If there are additional papers, attach to form and place both in an envelope addressed to preparing activity)*

SUBMITTED BY *(Printed or typed name and activity)*

DATE

DD FORM 1 APR 63 1426 REPLACES NAVSHIPS FORM 4063, WHICH IS OBSOLETE. AF-WP-O-MAY 64 505

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