INCH-POUND

MIL-A-82802(OS)
29 December 1989
SUPERSEDING
WS 21602B
9 December 1986

MILITARY SPECIFICATION

ADHESIVE AND SEALANT

This specification is approved for use by the Naval Sea Systems Command, Department of the Navy and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers one type of modified, low-flow, two-part (rigid) epoxy adhesive for use with heat-shrinkable products, referred to herein as the adhesive.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards and handbooks. The following specifications, standards and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commanding Officer, Naval Ordnance Station, Standardization Branch (3730), Indian Head, MD 20640-5000, 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

STANDARDS

FEDERAL

FED-STD-313	Material Safety Data, Transportation Data and Disposal Data for Hazardous Materials Furnished to Government Activities

MILITARY

MIL-STD-129	Marking for Shipment and Storage

SPECIFICATIONS

MILITARY

MIL-H-5606	Hydraulic Fluid, Petroleum Base; Aircraft, Missile, and Ordnance
MIL-T-5624	Turbine Fuel, Aviation, Grades JP-4, JP-5 and JP-5/JP-8 ST

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from: Military Specifications and Standards, Bldg. 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094).

2.1.2 **Other Government documents, drawings, and publications.** The following other Government documents, drawings, and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation.

CODE OF FEDERAL REGULATIONS (CFR)

49 CFR 100-199	Transportation

(Application for copies of CFRs should be addressed to the Superintendent of Documents, U. S. Government Printing Office, Washington, D.C. 20402-0001.)

2.2 **Non-Government publications.** The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the issue of the DODISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS are the issues of the documents cited in the solicitation (see 6.2).

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 149	Standard Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical

Insulating Materials at Commercial Power Frequencies (DoD adopted)

ASTM D 570 Standard Test Method for Water Absorption of Plastics

ASTM D 740 Methyl Ethyl Ketone (DoD adopted)

ASTM D 1002 Standard Test Method for Strength Properties of Adhesives in Shear by Tension Loading (Metal-To-Metal) (DoD adopted)

ASTM D 3149 Crosslinked Polyolefin Heat-Shrinkable Tubing for Electrical Insulation

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103-1187.)

AMERICAN TRUCKING ASSOCIATION, INC.

National Motor Freight Classification

(Application for copies should be addressed to the American Trucking Association, Inc., Attn: Traffic Dept., 2200 Mill Road, Alexandria, VA 22314-4677.)

NATIONAL RAILROAD FREIGHT COMMITTEE

Uniform Freight Classification (UFC) 6000

(Application for copies should be addressed to the National Railroad Freight Committee, 222 South Riverside Plaza, Suite 1120, Chicago, IL 60606-5945.)

(Non-Government standards and other publications are normally available from the organizations that prepare or 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 document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 **First article.** When specified (see 6.2), a sample shall be subjected to first article inspection (see 6.3) in accordance with 4.3.

3.2 **Material.** The adhesive shall be a 2-part adhesive resin consisting of an epoxy resin (Part A) and an amine-type curing agent (Part B) formulated in accordance with the following:

a. Part A: 50 ± 1 parts by weight

b. Part B: 50 ± 1 parts by weight

3.2.1 **Kits.** The adhesive shall be supplied in kits consisting of separate containers for part A and part B.

3.3 **Chemical and physical properties.** Chemical and physical properties of the adhesive shall conform to the requirements specified in table I.

3.4 **Safety.**

3.4.1 **Toxic products and formulations.** The material shall have no adverse effect on the health of personnel when used for its intended purpose. Questions pertinent to this effect shall be referred by the contracting activity to the appropriate departmental medical service who will act as an advisor to the contracting agency (see 4.1.2).

3.4.2 **Material Safety Data Sheet (MSDS).** The contractor shall prepare and submit a MSDS in accordance with FED-STD-313 as specified in the contract (see 6.4).

3.5 **Shelf life.** The adhesive specified herein shall have a shelf life of 12 months after date of manufacture when stored at 27°Celsius (°C) maximum.

3.5.1 **Shelf life extension.** The shelf life expiration date of an individual lot may be extended for additional 6-month periods provided the adhesive upon retest, conforms to peel strength and pot life requirements specified in table I.

3.6 **Workmanship.** The adhesive component materials shall be free from agglomeration, foreign matter, separation, dilution, or contamination.

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 (examinations and tests) 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 ensure supplies and services conform to prescribed requirements.

TABLE I. Chemical and physical properties.

Property	Mixed Material	
	Minimum	Maximum
Peel Strength, polyethylene aluminum 1/, Pounds per inch width (piw)	10	---
Polyethylene steel, piw	10	---
Flow at:		
Ambient temperature, inch	---	1.0
Cure temperature, inch	---	1.0
Lap shear strength, pounds per square inch (psi)	1000	---
Dielectric strength, volts/millimeter	100	
Solvent resistance, 24 hours at 25°C		
JP 4		
SKYDROL 500		
Hydraulic fluid (MIL-H-5606)		
Water		
Followed by peel strength, piw	10	---
Water absorption, 24 hours at 23°C, Percent	---	1.0
Pot life (hours)	1.0	---

1/ Crosslinked polyethylene conforming to ASTM D 3149, Type I.

4.1.1 Responsibility for compliance. All items shall 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 ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

4.1.2 **Toxicological product formulations.** The contractor shall have the toxicological product formulations and associated information available for review by the contracting activity to evaluate the safety of the material for the proposed use.

4.2 **Classification of inspections.** The inspection requirements specified herein are classified as follows:

a. First article inspection (see 4.3).

b. Quality conformance inspection (see 4.4).

4.3 **First article inspection.** First article inspection shall consist of the quality conformance inspections specified in table II, and lap shear (see 4.5.4), dielectric strength (4.5.5), solvent resistance (4.5.6), and water absorption (4.5.7) tests.

4.4 **Quality conformance inspection.** Quality conformance inspection shall consist of the examination and tests specified in table II.

TABLE II. Quality conformance inspection.

Examination and tests	Requirement	Test Method
Visual examination	3.6 and section 5	4.5.1
Peel strength test	3.3	4.5.2
Flow test	3.3	4.5.3
Pot life test	3.3	4.5.8

4.4.1 **Sampling for inspection.**

4.4.1.1 **Lot.** For inspection purposes, a lot of adhesive shall consist of the material of each part compounded and mixed in a single container in one mixing period without change in process or materials and subject to inspection at one time.

4.4.1.2 **Sample material.** Sampling for tests shall consist of a minimum of at least 1 quart of part A with sufficient part B for proper composition, with each part selected at random from each lot.

4.4.1.3 **Sampling for visual examination.** Sampling for visual examination to determine conformance to 5.1 and 5.2 shall consist of a random selection of at least 10 percent of the lot. Sampling for visual examination to determine

conformance to 3.6 shall consist of the sample selected in accordance with 4.4.1.2.

4.4.1.4 Noncompliance of samples. Failure of one or more of the sample containers of material to meet all of the specified requirements shall be cause for rejection of the lot.

4.5 Methods of inspection. The following inspection methods shall be used. Unless otherwise specified in the method, all weights, volumes, temperatures, and times shall be measured to the nearest specified unit or decimal.

NOTE: Reagent grade chemicals shall be used for chemical reactions in the conduct of all tests defined herein. Solvents and indicators may be commercial nonreagent grade materials.

4.5.1 Visual examination. Each sample of material (see 4.4.1.2 and 4.4.1.3) shall be visually examined for conformance to sections 3 and 5.

4.5.2 Peel strength test. Peel strength of each sample shall be determined by a rolling drum peel test according to 4.5.2.5. The substrates shall be a 1-inch-diameter mandrel of 2024-T3 aluminum alloy, a 1-inch-diameter mandrel of mild steel, and an extruded length of 1.5-inch-diameter heat shrinkable tubing conforming to ASTM D 3149, Type I.

4.5.2.1 Aluminum substrate preparation. The 6 inch aluminum mandrel shall be cleaned in a solvent or alkaline solution and etched with a solution consisting of the following parts by weight:

a. 30 parts water.

b. 10 parts sulfuric acid (specific gravity 1.84).

c. 1 part sodium dichromate .

The etching solution temperature shall be 65 $\pm$ 3°C. The mandrels shall be immersed in the solution for 10 minutes, water rinsed, air dried at room temperature for 15 minutes, and then forced dried for 20 minutes in a 65 $\pm$ 10°C mechanical convection oven in which air passes the mandrels at a velocity of 100 to 200 feet per minute. The mandrels shall then be removed from the oven, cooled to room temperature, and used within 2 hours.

4.5.2.2 Steel substrate preparation. Lightly abrade the outer surface of the steel mandrel with a number 320 emery cloth and then wipe with a lint-free cloth or paper towel wet with methyl ethyl ketone (MEK) conforming to ASTM D 740.

4.5.2.3 Polyethylene substrate preparation. The heat shrinkable tubing shall be lightly abraded on the inner diameter with a number 320 emery cloth and then wiped with a lint-free cloth or paper towel wet with MEK.

4.5.2.4 **Assembly procedure.** The mixed adhesive shall be applied to the entire mandrel and the abraded tubing so that the adhesive on each substrate shall be 0.010 ± 0.002 inch thick. The heat shrinkable tubing shall then be placed over the mandrel and recovered in an oven at 121 ± 3°C for a minimum of 20 minutes. The test specimens shall be stored for a minimum of 72 hours at 23 ± 2°C before testing. The test specimens shall be prepared by circumferentially slitting the tubing in 1-inch widths on the mandrel.

4.5.2.5 **Test procedure.** The specimens shall be slit axially and peeled from the mandrel in a suitable tensile test machine such that the tubing peels off at a rate of 2 inches per minute as the mandrel rotates. The test shall be conducted at a temperature of 23 ± 2°C. The mean peel off force for each specimen shall be recorded, and the average of 5 recorded measurements shall be reported as the peel strength. Report results in pounds per inch width (piw). If the tubing breaks before the adhesive peels, with a force at or above 10 piw, the peel strength is acceptable. If the tubing breaks below 10 piw, increase tubing thickness and repeat the test.

4.5.3 **Flow test.**

4.5.3.1 **At room temperature.** Three grams of mixed adhesive shall be formed in a compact mass 1.0 ± 0.2 inch in diameter on a smooth glass surface that has been cleaned with MEK. The glass shall be placed on edge and marked with a line tangent to the bottom edge of the adhesive. After 10 minutes, the glass shall again be marked with a line tangent to the bottom edge of the adhesive and the distance between the marked lines shall be measured. The distance between lines shall be as specified in 3.3.

4.5.3.2 **At cure temperature.** The same glass with adhesive shall then immediately be mounted vertically in an oven maintained at 121 ± 3°C. After 10 minutes, the glass again shall be marked on a line tangent to the bottom edge of the adhesive and the distance between the second and third lines shall be measured. The distance between lines shall be as specified in 3.3.

4.5.4 **Lap shear strength test.** Lap shear strength (aluminum to aluminum) shall be determined at room temperature as specified in ASTM D 1002. Preparation of aluminum substrates shall be in accordance with 4.5.2.1. The samples shall be cured in an oven at 121 ± 3°C for 45 minutes and stored for a minimum of 24 hours at 23 ± 2°C before testing.

4.5.5 **Dielectric strength test.** Two 6- by 6-inch squares of 0.004-inch-thick polyethylene film shall be coated on one side with a release agent. Three grams of mixed and deaerated [1/] adhesive shall be spread on the coated side of one of the films as a disk from 1 to 3 inches in diameter. The adhesive shall be covered with the second coated film, and the adhesive and films shall be placed between 6- by 6-inch metal plates. The plates shall be pressed together until the intervening disk of adhesive is from 0.005 to 0.250 inch thick. This assembly shall be cured for 2 hours in an oven maintained at a temperature of 95 ± 3°C. After curing, the disk of adhesive shall be removed from the assembly,

cooled to room temperature, and tested for dielectric strength conforming to the short-time test of ASTM D 149.

1/ After the compound has been thoroughly mixed, deaerate the mixture under a minimum vacuum of 27 inches of mercury (2.9 inches of mercury absolute). Vacuum the material three times, each time breaking the vacuum to allow the mixture to collapse and the air to escape.

4.5.6 Solvent resistance test. Three specimens prepared as specified in 4.5.2 shall be completely immersed in each of the following solvents for 24 ± 2 hours at 23 ± 2°C.

a. MIL-T-5624, Grade JP-4

b. Skydrol 500

c. MIL-H-5606, Hydraulic Fluid

d. Water

After immersion, the specimens shall be lightly wiped and air dried for 30 to 60 minutes at room temperature. The specimens shall then be tested for peel strength as specified in 4.5.2.5.

4.5.7 Water absorption test. The water absorption shall be determined in accordance with ASTM D 570. The samples shall be prepared as specified in 4.5.5 except that the thickness shall be from 0.025 to 0.050 inch. The samples shall be immersed for 24 hours at 25 ± 3°C.

4.5.8 Pot life test. The adhesive shall be mixed and allowed to set for 1 hour. At the end of this time, peel specimens shall be prepared and tested in accordance with 4.5.2.

4.6 Inspection of packaging. The adhesive containers and container markings shall be visually examined to verify compliance with section 5.

5. PACKAGING

5.1 Packaging. Unless otherwise specified in the contract or order (see 6.2), packaging shall be level C as specified herein.

5.1.1 Level C. The adhesive shall be packaged to afford adequate protection against loss, contamination, deterioration and damage during shipment from the supply source to the first receiving activity and during storage under the shelf life period and conditions specified in 3.5. Containers in the same shipment shall be of the same size. The packaging shall conform to UFC 6000, National Motor Freight Classification, 49 CFR 171-178 or to other carrier rules and regulations as applicable to the mode of transportation.

5.2 **Marking.**

5.2.1 **Standard marking.** In addition to any special marking required by the contract or order (see 6.2), the kits shall be marked in accordance with MIL-STD-129.

5.2.2 **Special marking.** In addition to the marking requirements of 5.2.1, each kit marking shall include the following information:

a. Title, number and date of this specification.

b. Manufacturer's name and address.

c. Material trade name and identification.

d. Net weight of contents.

e. Lot number and date of quality conformance inspection.

f. Shelf life and inspection/test date for extension (see 3.5.1). In addition, the marking shall include the following:

"SHELF LIFE EXTENSION

THE SHELF LIFE OF AN INDIVIDUAL LOT MAY BE EXTENDED FOR ADDITIONAL 6 MONTH PERIODS PROVIDED THE PEEL STRENGTH AND POT LIFE, UPON RETEST, CONFORMS TO THE REQUIREMENTS SPECIFIED IN MIL-A-82802".

6. **NOTES**

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 **Intended use.** The adhesive specified herein is intended for general use in structural bonding of components in the Dual Thrust Rocket Motor, Mark 104, of the Standard Missile.

6.2 **Acquisition requirements.** Acquisition documents must specify the following:

a. Title, number and date of this specification.

b. Issue of DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.1.1, 2.1.2 and 2.2).

c. Whether first article is required (see 3.1 and 6.3).

d. Material Safety Data Sheets (see 3.4.2 and 6.4).

6.3 First article. When first article inspection is required, the contracting officer should provide specific guidance to offerors on the material to be inspected. The material should be a first article sample and should consist of a quantity of the adhesive sufficient to perform all of the inspections specified in 4.3. The first article sample should be packaged and marked as specified in section 5. The contracting officer should include specific instructions in acquisition documents regarding arrangements for examinations, approval of first article test results and disposition of first articles. Invitations for bids should provide that the Government reserves the right to waive the requirement for samples for first article inspection to those bidders offering a product which has been previously acquired or tested by the Government, and that bidders offering such products, who wish to rely on such production or test, must furnish evidence with the bid that prior Government approval is presently appropriate for the pending contract.

6.4 Material Safety Data Sheet (MSDS). MSDS requirements are applicable to this specification and should be specified in the contract as required by the Federal Acquisition Regulation (FAR), Part 23, Subpart 23.3. Contracting officers will identify those activities requiring copies of completed MDSDs prepared in accordance with FED-STD-313. The pertinent Government mailing addresses for submission of data are listed in FED-STD-313.

6.5 Possible material. The following material has been found to meet the requirements of this specification. This is only given for information and is not restrictive.

Raychem S-1139 - manufactured by Raychem Corporation.

6.6 Subject term (key word) listing.

Rocket Motor, Dual Thrust, Mark 104
Standard Missile

Preparing Activity:
NAVY-OS
(Project 8040-N147)

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.
2. The submitter of this form must complete blocks 4, 5, 6, and 7.
3. The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

I RECOMMEND A CHANGE:	1. DOCUMENT NUMBER MIL-A-82802	2. DOCUMENT DATE (YYMMDD) 29 December 1989

3. DOCUMENT TITLE
ADHESIVE AND SEALANT

4. NATURE OF CHANGE *(Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)*

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME (Last, First, Middle Initial)	b. ORGANIZATION	
c. ADDRESS (Include Zip Code)	d. TELEPHONE (Include Area Code) (1) Commercial (2) AUTOVON (If applicable)	7. DATE SUBMITTED (YYMMDD)

8. PREPARING ACTIVITY NAVAL ORDNANCE STATION (CODE 3730) INDIAN HEAD, MD 20640-5000

a. NAME	b. TELEPHONE (Include Area Code) (1) Commercial (2) AUTOVON
c. ADDRESS (Include Zip Code)	IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT: Defense Quality and Standardization Office 5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466 Telephone (703) 756-2340 AUTOVON 289-2340