MIL-A-47074A(MI)
2 March 1983
SUPERSEDING
MIL-A-47074(MI)
10 May 1974

MILITARY SPECIFICATION

ADHESIVE SYSTEM, EPOXY, FOR DISSIMILAR METAL BONDING

* This specification is approved for use by Army Missile Command, Department of the Army, and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

* 1.1 Scope. This specification covers 2 types of epoxy resin adhesive systems for bonding of dissimilar metal.

1.2 Classification.

1.2.1 Types. The epoxy adhesive compound shall be of the following types. Unless otherwise specified, Type II shall be furnished (see 6.2).

a. Type I, flowable.

b. Type II, nonflowable.

1.2.2 Classes. The epoxy adhesive compound shall be of the following classes. Unless otherwise specified, Class 2 shall be used (see 6.2).

a. Class 1, high peel strength requirement.

b. Class 2, no peel strength requirement.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, US Army Missile Command, ATTN: DRSMI-RSDS, Redstone Arsenal, AL 35898 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) at the end of this document or by letter.

FSC 8040

* 1.3 Military part number. The military part number shall consist of the letter B, the basic number of this specification and dash numbers which identify type and class.

Example of part number:

B47074	-	I	-	2
Basic spec		Type (1.2.1)		Class (1.2.2)

2. APPLICABLE DOCUMENTS

* 2.1 Government documents.

* 2.1.1 Specifications, standards, and handbooks. Unless otherwise sepcified, the following specifications, standards, and handbooks of the issue listed in that issue of the Department of Defense Index of Specifications and Standards (DoDISS) specified in the solicitation form a part of this specification to the extent specified herein.

SPECIFICATIONS

Federal

MMM-A-132	Adhesives, Heat Resistant, Airframe Structural, Metal to Metal
* PPP-B-601	Boxes, Wood, Cleated Plywood
* PPP-B-621	Box, Wood, Nail and Lock Corner
* PPP-C-96	Can, Metal, 28 Gage and Lighter

Military

* MIL-P-116	Preservation, Methods of
MIL-A-9067	Adhesive Bonding, Process and Inspection Requirements For

STANDARDS

Military

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

* MIL-STD-1188 Commercial Packaging of Supplies and Equipment

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

* 2.1.2 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein, the text of this specification shall take precedence.

3. REQUIREMENTS

* 3.1 First article. When specified, a sample shall be subjected to first article inspection (see 4.4 and 6.2).

3.2 Material.

3.2.1 Composition and condition in container.

3.2.1.1 Composition. The materials for Type I and Type II shall consist of a nitrile-phenolic primer and a thixotropic epoxy-based adhesive compound. The adhesive compound shall be a two-component, epoxy-resin based 100 percent solids system, consisting of Part A, which contains epichlorhydrin-bisphenol A Type resin plus iron oxide filler, and Part B which contains a polyamide resin plus titanium dioxide. In the case of Type II compound a colloidal silica filler is added to increase viscosity.

3.2.1.2 Condition in container. The materials as received shall be free of gel particles, dirt, and any contaminants which would affect the intended use.

3.2.2 Flow properties. The flow properties of materials shall be as specified in Table I.

* TABLE I. Flow properties

Material type	Flow, inch
I	More than 1.00
II	Less than 0.25

3.3 Performance characteristics.

3.3.1 Shear strength. The cured adhesive system shall meet the shear strength requirements specified in Table II.

TABLE II. Shear strength

Temperature, (±5°F) (±3°C)	Shear strength, pounds per square inch (psi), minimum
-65°F (-54°C)	2100
77°F (25°C)	2600
160°F (71°C)	1350
200°F (93°C)	560

3.3.2 Peel strength (Class 1 only). The minimum average T-peel strength of the Class 1 adhesive system shall be 50 pounds per inch of width.

3.4 Environmental conditions.

3.4.1 Thermal cycling. After thermal cycling, the bonded joint shall meet the shear strength requirements of Table II.

3.5 Workmanship. The workmanship shall be such as to ensure a product which is uniform and in conformance with this specification. All the materials shall be free of dirt, foreign matter, or other contaminants.

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.

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

a. First article inspection (see 4.4).

b. Quality conformance inspection (see 4.5).

* 4.3 Inspection conditions. Unless otherwise specified, all inspections shall be performed in accordance with the test conditions specified in 4.7.

* 4.4 First article inspection. When specified in the contractual document (see 6.2), a sample consisting of a 1-pint kit of primer and adhesive, manufactured under the same conditions as those proposed for subsequent production, shall be subjected to first article inspection. Accomplishment of first article inspection shall be as specified herein. If the first article sample does not meet the requirements of this specification, it shall be rejected. Subsequent units shall not be considered for acceptance until Government approval of the first article sample has been obtained. Units subjected to first article inspection shall have successfully passed acceptance inspection. Testing of the first article sample, to determine compliance with the characteristics listed in Table III, shall be conducted in accordance with the corresponding test paragraphs.

* TABLE III. First article inspection

Characteristic	Requirement source	Test paragraph
Composition and condition in container	3.2.1	4.7.4.1
Flow properties	3.2.2	4.7.4.2
Shear strength	3.3.1	4.7.4.3
Peel strength (Class 1 only)	3.3.2	4.7.4.4
Thermal cycling	3.4.1	4.7.4.5
Workmanship	3.5	4.7.5

* 4.5 Quality conformance inspection.

* 4.5.1 Sampling for acceptance inspection. When sampling for acceptance inspection is specified, it shall be conducted in accordance with MIL-STD-105, at an acceptable quality level (AQL) of 4.0 percent defective.

* 4.5.2 Lot formation. A lot shall consist of all the material manufactured in one continuous operation by the same process, by the same manufacturer in accordance with this specification and submitted for inspection at one time.

* 4.5.3 Acceptance inspection. Acceptance inspection of the sample specified in 4.5.1, to determine compliance with the characteristics specified in Table IV shall be conducted in accordance with the corresponding test and inspection paragraphs.

* TABLE IV. Acceptance inspection

Characteristic	Requirement source	Test and inspection paragraph
Composition and condition in container	3.2.1	4.7.4.1
Flow properties	3.2.2	4.7.4.2
Shear strength at room temperature	3.2.1	4.7.4.3
Workmanship	3.5	4.7.5

* 4.6 Inspection equipment. The inspection equipment for conducting examination and tests shall be as specified in the applicable test methods and procedures paragraphs.

* 4.7 Test methods and procedures.

* 4.7.1 Test conditions. Unless otherwise specified herein, the following conditions shall be used as a basis to establish performance requirements:

a. Temperature, room ambient plus or minus 9 degrees Celsius (C).

b. Altitude, facility ground.

c. Humidity, facility ambient up to 95 percent relative humidity.

* 4.7.2 Test sequence. Testing within each classification of inspection (first article or acceptance) shall be at the option of the contractor.

4.7.3 Test specimen preparation. Specimens for shear strength and thermal cycling tests shall be prepared as follows:

a. Fabricate specimens using one 6061-T6 aluminum strip and one 302 annealed stainless steel strip. Strip dimensions shall be 1 by 3 by 0.063 inch.

b. Clean the adherends with the cleaning procedures recommended in MIL-A-9067.

* c. Prime both surfaces with nitrile-phenolic primer, mixed and cured in accordance with manufacturer's instructions.

d. Mix equal Parts A and B of the epoxy adhesive.

e. Apply the mixed adhesive to both mating surfaces of the specimens. Bond in place with a 0.50 inch overlap and cure per manufacturer's instructions.

* 4.7.4 Tests.

* 4.7.4.1 Composition and condition in container. Composition and condition in container shall be examined visually to establish compliance to 3.2.1.

* 4.7.4.2 Flow properties. The test for flow properties shall be as specified below. The flow properties shall conform to 3.2.2.

a. Fabricate specimens in accordance with Figure 1 (3 specimens minimum for each adhesive).

b. Within 5 minutes after mixing of adhesive, place prepared specimen vertically in a preheated (150 degrees plus or minus 5 degrees F) (66 degrees plus or minus 3 degrees C) circulating air oven.

c. Remove specimen from oven within 30 to 60 minutes.

d. Measure the distance the adhesive has flowed from the initial reference line.

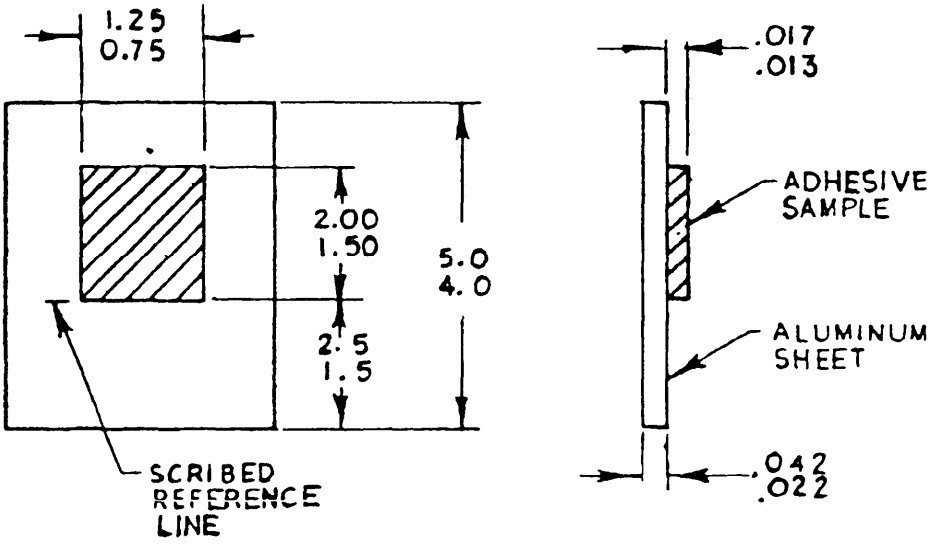

Figure 1. Flow test specimen

Note: Unless otherwise specified, all dimensions are in inches.

* 4.7.4.3 Shear strength. Five specimens prepared as specified in 4.7.3 shall be tested for each temperature specified in 3.3.1. The specimens shall be tested in accordance with MMM-A-132 except that the temperature shall be as specified herein. The strength values shall conform to 3.3.1.

* 4.7.4.4 Peel strength (Class 1 only). Six specimens shall be prepared and tested in accordance with MMM-A-132 to establish conformance to 3.3.2.

* 4.7.4.5 Thermal cycling. Five specimens prepared as specified in 4.7.3 shall be subjected to 5 cycles as specified below and shall conform to 3.4.1.

a. Place in refrigerator at minus 65 degrees plus or minus 5 degrees Fahrenheit (F) (minus 54 degrees plus or minus 3 degrees C). Hold at this temperature for at least 10 minutes.

b. Place in oven at room temperature and raise temperature to 200 degrees plus or minus 10 degrees F (94 degrees plus or minus 5.5 degrees C). Hold at 200 degrees plus or minus 10 degrees F (94 degrees plus or minus 5.5 degrees C) for at least 10 minutes.

c. Cool to room temperature.

d. Repeat steps (a), (b), and (c), 4 additional times.

* 4.7.5 Visual inspection and examination. The material shall be visually examined to assure conformance to the workmanship requirement specified in 3.5.

* 5. PACKAGING

5.1 Preservation, packing, unitization and marking shall be Level A, B, or Industrial (see 6.2).

5.1.1 Level A. The Adhesive Primer shall be packaged in accordance with MIL-P-116. Method 1A-5, using container conforming to PPP-C-96.

5.1.2 Level B. Same as Level A.

5.1.3 Industrial. Preservation and packaging shall be in accordance with MIL-STD-1188.

* 5.2 Packing.

5.2.1 Level A. Containers conforming to PPP-C-96 shall be packed in snug-fitting boxes conforming to PPP-B-601, overseas type or PPP-B-621, Class 2, as applicable.

5.2.2 Level B. Same as Level A, except domestic style containers shall be utilized.

5.2.3 Industrial. Packing shall be in accordance with MIL-STD-1188.

* 5.3 Marking.

5.3.1 Level A or B. Marking shall be in accordance with MIL-STD-129. Additional markings shall include, but not be limited to the following:

a. Manufacturer's name and address.

b. Manufacturer's designation.

c. Lot number or batch number.

d. Date of manufacture.

e. Number of this specification.

f. Type and class.

5.3.2 Industrial. Marking shall be in accordance with MIL-STD-1188. Additional markings shall include, but not be limited to the following:

a. Manufacturer's name and address.

b. Manufacturer's designation.

c. Lot number or batch number.

d. Date of manufacture.

e. Number of this specification.

f. Type and class.

6. NOTES

6.1 Intended use. The adhesive system in accordance with this specification is used in applications where dissimilar or like combinations of metals are bonded and dimensional stability is required.

* 6.2 Ordering data. Procurement document should specify the following:

a. Title, number, and date of this specification.

* b. Military part number (see 1.3).

* c. Whether a first article sample is required (see 3.1), and if so, pertinent details.

d. Type and class required (see 1.2).

e. Quantity and size of containers.

* f. Packaging level required (see 5.1).

6.3 Supersession data. This specification includes the requirements of Missile Interim Specification MIS-13894A, dated 4 August 1970.

* 6.4 Changes from previous issue. The margins of this specification are marked with asterisks to indicate where changes (additions, modifications, corrections, deletions) from the previous issue 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 based on the entire content irrespective of the marginal notations and relationship to the last previous issue.

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Project No. 8040-A102

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

OMB Approval
No. 22-R255

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MIL-A-47074A(MI) ADHSEIVE SYSTEM, EPOXY, FOR DISSIMILAR METAL BONDING

NAME OF ORGANIZATION AND ADDRESS	CONTRACT NUMBER
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