

FEDERAL SPECIFICATION

ADHESIVE AND SEALING COMPOUND,
EPOXY, METAL FILLED

This specification was approved by the Commissioner,
Federal Supply Service, General Services Administration,
for the use of all Federal agencies.

1. SCOPE

1.1 Scope. This specification establishes the requirements for one type of metal filled, room temperature curing, two part epoxy adhesive and sealing compound.

2. APPLICABLE DOCUMENTS

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

Federal Specifications.

QQ-A-250/5 - Aluminum Alloy Alclad 2024, Plate and Sheet
 PPP-B-566 - Boxes, Folding, Paperboard
 PPP-B-636 - Box, Fiberboard
 PPP-B-665 - Boxes, Paperboard, Metal Stayed (Including Stay Material)
 PPP-B-676 - Boxes, Set-up
 PPP-C-96 - Cans, Metal, 28 Gage and Lighter

Federal Standards.

Fed. Std. No. 123 - Marking for Domestic Shipment (Civilian Agencies)
 Fed. Test Method Std. No. 141 - Paint, Varnish, Lacquer, and Related Materials;
 Methods of Inspection, Sampling, and Testing

(Activities outside the Federal Government may obtain copies of Federal Specifications, Standards, and Handbooks as outlined under General Information in the Index of Federal Specifications and Standards and at the prices indicated in the Index. The Index, which includes cumulative monthly supplements as issued, is for sale on a subscription basis by the Superintendent of Documents, U. S. Government Printing Office, Washington, DC 20402.

(Single copies of this specification and other Federal Specifications required by activities outside the Federal Government for bidding purposes are available without charge from Business Service Centers at the General Services Administration Regional Offices in Boston, New York, Washington, DC, Atlanta, Chicago, Kansas City, MO, Ft. Worth, Denver, San Francisco, Los Angeles, and Seattle, WA.

(Federal Government activities may obtain copies of Federal Specifications, Standards, and Handbooks and the Index of Federal Specifications and Standards from established distribution points in their agencies.)

Military Standards:

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

(Copies of Military Specifications and Standards required by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

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

American Society for Testing and Materials (ASTM) Standards:

- D 618 - Conditioning Plastics and Electrical Insulating Materials for Testing
- D 638 - Tensile Properties of Plastics
- D 695 - Compressive Properties of Rigid Plastics
- D 790 - Flexural Properties of Plastics
- D 1002 - Strength Properties of Adhesives in Shear by Tension Loading (Metal-To-Metal)
- D 2471 - Gel Time and Peak Exothermic Temperature of Reacting Thermosetting Plastic Compositions
- D 2651 - Preparation of Metal Surfaces for Adhesive Bonding
- D 2730 - Sag Flow of Highly Viscous Materials

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

3. REQUIREMENTS

3.1 Material. The adhesive shall consist of two components, a base polymer and an activator, so compounded and formulated that when mixed in accordance with instructions (see 3.5) shall produce an adhesive meeting the requirements of this specification.

3.1.1 Base polymer. The base polymer shall be of the epoxy type, and shall contain finely divided particles of aluminum, steel, or both, and such other fillers as are required.

3.1.2 Activator. The activator shall be of the polyamide type, and may contain fillers or such other inert ingredients as may be required.

3.1.3 Thinner. If required for attainment of specified working characteristics (see 3.2), a thinner compatible with the mixed adhesive components shall be furnished.

3.1.4 Form. The base polymer shall be of paste form. The activator shall be a paste or liquid; and the thinner, if required, shall be a liquid. The forms in all cases shall be such as to assure conformance with 3.2.

3.1.5 Color. The color of the mixed adhesive shall be neutral gray, and color differences between the mixed adhesive and either base resin or activator shall be at least 5 NBS units.

3.1.6 Corrosion. The adhesive shall be non-corrosive to metal surfaces being bonded.

3.1.7 Solids. The complete adhesive system, exclusive of any thinner which may be added for attainment of working characteristics (see 3.1.3), shall be free of volatile solvents. The average nonvolatile matter in the adhesive system shall be not less than 97.0 percent when tested as specified in 4.4.5.

3.2 Working characteristics.

3.2.1 Application. The adhesive, when mixed according to the manufacturer's instructions (see 3.5), shall be smooth, free of lumps, and shall be of consistency suitable for application. The individual components shall not settle, nor shall the mixed components separate or settle out during normal pot life. The adhesive shall be capable of being applied at room temperatures between 60° and 100°F. (16° to 38°C.) and at relative humidity of not more than 75 percent.

3.2.1.1 Sag flow. The mixed adhesive shall not exhibit sag flow of more than 0.5 inch when tested as specified in Table III.

3.2.2 Application life (pot life). The application life of the adhesive when mixed and ready for use at $75^{\circ} \pm 5^{\circ}\text{F.}$ ($23.9^{\circ} \pm 2.8^{\circ}\text{C.}$) shall be at least 15 minutes for a 100 gram mass and at least 30 minutes for a 10 gram mass when tested as specified in Table III.

3.2.3 Curing time. The adhesive shall attain the minimum strength requirements specified herein when cured 24 hours at $75^{\circ} \pm 5^{\circ}\text{F.}$ ($23.9^{\circ} \pm 2.8^{\circ}\text{C.}$). Full cure shall not exceed 7 days.

3.3 Mechanical properties. Mechanical properties of test specimens prepared and tested as specified in Section 4 shall conform to the respective requirements listed in Table I.

TABLE I. Mechanical properties

Tensile shear, psi	
at $75^{\circ} \pm 5^{\circ}\text{F.}$	2300 minimum
at 140°F.	1000 minimum
at -67°F.	1500 minimum
Tensile strength, psi	2500 minimum
Flexural strength, psi	5500 minimum
Flexural bond strength	150 lbs./inch bond minimum
Compressive yield, psi	5000 minimum

3.4 Storage stability. After the separate components are stored as specified in 4.4.6, the prepared adhesive (see 3.5) shall conform to the following requirements:

- (a) All requirements of 3.2.1.
- (b) Sag flow shall not exceed plus 10 percent of the maximum specified in 3.2.1.1.
- (c) Application life shall vary not more than minus 10 percent from the values specified in 3.2.2.
- (d) Curing time shall vary not more than plus 10 percent from the values specified in 3.2.3.
- (e) Tensile shear shall vary not more than minus 5 percent from the values specified in Table I.

3.5 Instruction sheet. The manufacturer shall provide instructions for use with each kit of adhesive. The instructions shall include the following information.

- (a) Proportions by weight of components to be mixed; mixing instructions, including any controls necessary during mixing; and maximum pot life of the mixed adhesive.
- (b) Application instructions, including spread method, number of coats, weight range, application temperature, and acceptable glue line (bond) thickness range.
- (c) Typical time, temperature, and pressure for each segment of the complete curing cycle, giving minimum and maximum limits for each condition.
- (d) Instructions for use of thinner and clear-up.
- (e) Necessary safety precautions to be observed throughout all operations.
- (f) Storage, handling, and shelf life information.

The instructions may be included as a separate sheet or may be incorporated into the kit label.

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 purchase 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

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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 that supplies and services conform to prescribed requirements.

4.2 Sampling.

4.2.1 Lot. For purposes of sampling, a lot shall consist of all adhesive manufactured as one batch and offered for delivery at one time.

4.2.2 Sampling for inspection of filled containers. A random sample of filled containers shall be selected in accordance with MIL-STD-105 at inspection level I and acceptable quality level (AQL) = 2.5 percent defective to verify compliance with this specification regarding fill, closure, and marking, and other requirements not involving tests.

4.2.3 Sampling for lot acceptance. From each inspection lot, two containers of each component shall be selected at random. From each of the two containers, one pint of the material shall be taken and placed in separate, clean, dry metal or glass containers, sealed, marked, and forwarded to the testing laboratory. Where packaging of the lot is in containers of less than one-pint capacity, a sufficient number of the smaller size containers shall be selected so that the specified two, one-pint samples of each component are available for forwarding to the testing laboratory.

4.2.4 Sampling for preparation of delivery. A quantity of shipping containers prepared for delivery, just prior to closure, shall be inspected in accordance with Inspection Level S-2 of MIL-STD-105 and examined in accordance with 4.3.2. The lot size for this inspection shall be the number of shipping containers.

4.3 Inspection.

4.3.1 Inspection of containers. Samples selected in accordance with 4.2.2 shall be examined for defects of construction of the container and the closure, for evidence of leakage, and for unsatisfactory markings, each filled container shall also be gaged to determine the amount of contents. Any container in the sample having one or more defects or under required fill shall be rejected. If the number of defective containers in any sample exceeds the acceptance number for the appropriate sampling plan of MIL-STD-105, the lot represented by the sample shall be rejected.

4.3.2 Inspection of preparation for delivery. Samples selected in accordance with 4.2.4 shall be inspected to determine that the preservation, packaging, packing, and marking comply with the requirements in Section 5 of this specification. Defects shall be scored in accordance with Table II. Defects of closure listed shall be examined on shipping containers fully prepared for delivery.

TABLE II. Classification of preparation for delivery defects

Examine	Defects
Markings (exterior and interior)	Omitted, incorrect; illegible; improper size, location, sequence, or use of application.
Materials	Any components missing or damaged.
Workmanship	Inadequate application of components such as incomplete closure of container flaps, loose strapping, inadequate stapling. Distortion of container, as applicable.
Contents (exterior container)	Number per container is more or less than required. Net weight exceeds requirements.

4.3.3 Lot acceptance tests. The samples selected in accordance with 4.2.3 shall be subjected separately to the tests specified in 4.4. If any one of the samples fails to pass any one of the tests specified, the lot represented thereby shall be rejected.

4.4 Test procedures. The adhesive, mixed as recommended (see 3.5), shall be tested in accordance with Table III. Unless otherwise specified, all tests shall be after curing 24 hours at $75^{\circ} \pm 5^{\circ}\text{F}$.

TABLE III. Test methods

Test	Method	Paragraph Giving Further Information	Paragraph Giving Requirement
Tensile shear	ASTM D 1002	4.4.1	Table I
Tensile strength	ASTM D 638	-	Table I
Flexural strength	ASTM D 790	-	Table I
Flexural bond strength	-	4.4.2	Table I
Compressive yield	ASTM D 695	4.4.3	Table I
Sag flow	ASTM D 2730	4.4.4	3.2.1.1
Application time	ASTM D 2471	-	3.2.2

4.4.1 Tensile shear strength. Adhesive shall be tested as specified in 4.4.1.1 for compliance with Table I.

4.4.1.1 Specimen preparation. Tensile shear shall be determined using aluminum alloy (QQ-A-250/5, 2024, T3, 0.063 inch thickness) panels that have been cleaned and prepared for bonding in accordance with ASTM D 2651, Method A. Two, 1 x 4 inch panels, overlapped 0.500 ± 0.01 inch with an adhesive bond line thickness of 0.001 to 0.005 inch, shall constitute 1 test specimen. Fifteen test specimens shall be prepared and cured as specified in 4.4. Testing shall be as specified in ASTM D 1002, at the temperatures described below:

Temperature	Conditioning Time, Minutes	Specimens Tested
$75^{\circ} \pm 5^{\circ}\text{F}$. ($23.9^{\circ} \pm 2.8^{\circ}\text{C}$.)	-	5
$140^{\circ} \pm 2^{\circ}\text{F}$. ($60^{\circ} \pm 1^{\circ}\text{C}$.)	30	5
$-67^{\circ} \pm 2^{\circ}\text{F}$. ($-55^{\circ} \pm 1^{\circ}\text{C}$.)	30	5

4.4.2 Flexural bond strength. Using a procedure similar to ASTM Method D 790, the flexural bond strength measurements are made by testing as a beam in flexure, a 1/2 x 5 inch overlap joint constructed with two steel coupons 0.125 x 1/2 x 4 inches. The midpoint of the tester is placed on the center of the adhesive bond, the contact points 2 inches either side of the midpoint of the span. Determine compliance with Table I.

4.4.3 Compressive properties. ASTM Method D 695 shall be used with the following addition. Test specimens may be cast or molded to test dimensions or machined to test dimensions from cast or molded stock. Condition test specimens in accordance with ASTM D 618. Determine compliance with Table I.

4.4.4 Sag flow. Sag flow shall be determined by ASTM Method D 2730 using the 1/4 inch channel. Check for compliance with 3.2.1.1.

4.4.5 Solids. Approximately 7 grams of the adhesive system shall be prepared by mixing recommended portions (see 3.5) by weight of the base polymer and activator, both of which have been conditioned at $75^{\circ} \pm 5^{\circ}\text{F}$ ($23.9^{\circ} \pm 2.8^{\circ}\text{C}$.) for 24 hours. The mixture shall be allowed to cool at $75^{\circ} \pm 5^{\circ}\text{F}$ ($23.9^{\circ} \pm 2.8^{\circ}\text{C}$.) until the exothermic

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reaction ceases. The specimen shall then be tested for nonvolatile matter by Method 4041 of Fed. Test Method Std. No. 141. Three samples shall be tested, and the average of the three shall be reported as solids in compliance with 3.1.7

4.4.6 Storage stability Store separate components in original, unopened containers for one year after the date of manufacture at $75^{\circ} \pm 10^{\circ}\text{F}$. Test the adhesive, mixed as recommended (see 3.5), in accordance with methods specified in Section 4 of this specification for conformance with 3.4. The manufacturer's authorized certification may be accepted in lieu of test data for conformance to 3.4.

5. PREPARATION FOR DELIVERY

5.1 Packaging. Adhesive shall be packaged in a 2, 6, or 11 ounce two-tube kit or bulk packaged in a pint, quart, or gallon kit as specified (see 6.2). Packaging shall be level A or C as specified (see 6.2). The kit shall be defined as the sum of the volumes of the base component and activator but not including any thinner (see 3.1.3) which may be furnished.

5.1.1 Level A.

5.1.1.1 Two-tube kits. The base component and activator component of the adhesive shall be packaged in individual collapsible metal tubes. The tubes shall consist of a seamless cylindrical body with integral shoulder and threaded neck. Tubes shall be fabricated of aluminum and shall have suitable flexible characteristics. Tube walls shall be of uniform thickness and may be treated with an interior protective coating. The tube shall be provided with a secure metal or plastic cap of the threaded or clip-on type dependent upon tube construction. The tube size and orifice shall be such that equal bead lengths of extruded activator and base will be the proper mixing ratio. One tube each of base and activator, comprising one kit, shall be packaged in a close-fitting box conforming to PPP-B-566, PPP-B-665, or PPP-B-676, with a partition made of the same material as the box. Boxes shall be secured to prevent accidental opening.

5.1.1.2 Bulk sizes. The base component and activator component shall be packaged in individual cans conforming to PPP-C-96, type V, class 2. One can each of base and activator, comprising one kit, shall be packaged in a close-fitting box conforming to PPP-B-636, class weather resistant. Boxes shall be closed in accordance with the appendix to PPP-B-636.

5.1.2 Level C. The base component and the activator component shall be kit packaged to afford protection against corrosion, deterioration, and damage from the supplier to the initial destination. The supplier may use his commercial practice providing it fulfills these requirements.

5.1.3 Instruction sheet. The manufacturer's instructions (see 3.5) shall be included in each kit. The instructions may be a separate sheet or may be incorporated in the kit label.

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

6.2.1 Level A. The adhesive, kit packaged as specified in 5.1.1 and in quantities as specified (see 6.2), shall be packed in a box conforming to PPP-B-636, class weather resistant. As far as is practical, the container shall be of minimum cube and tare consistent with protection required and contain identical quantities. The box shall be closed in accordance with the appendix to the box specification.

6.2.2 Level B. The adhesive, kit packaged as specified in 5.1.1 and in the quantities specified (see 6.2), shall be packed in a box conforming to PPP-B-636, class domestic. As far as is practical, containers shall be of minimum cube and tare consistent with protection required and contain identical quantities. The box shall be closed in accordance with Method II of the appendix to the box specification.

5.2.3 Level C. The adhesive, kit packaged as specified in 5.1.2 and in the quantities specified (see 6.2), shall be packed in shipping containers in a manner that will ensure safe transportation to the point of delivery. Containers shall meet common carrier regulations as applicable to the mode of transportation.

5.3 Marking. In addition to any special marking required by the contract or order, all marking shall be in accordance with 5.3.1 or 5.3.2, as specified (see 6.2).

5.3.1 Civil agencies. Marking shall be in accordance with Fed. Std. No. 123.

5.3.2 Military agencies. Marking shall be in accordance with MIL-STD-129.

5.3.3 Special marking. In addition to other markings required, individual containers, intermediate packages, and shipping containers shall be marked to show the following information

- (a) Date of manufacture (by month and year)
- (b) First reinspection date (one year after date of manufacture, by month and year).
- (c) Store below 80°F in absence of direct light

6. NOTES

6.1 Intended use. An epoxy based adhesive, using a polyamide activator, in general, may be expected to act as an adhesive, sealing compound, or molding compound for both general purpose and structural applications, such as on fairing surfaces. Cured adhesive can be sanded, filed, or machined with conventional tools. This adhesive will bond to steel, iron, aluminum, glass (not Pyrex), concrete, ceramics, porcelain, tile, marble, wood, and thermosetting plastics such as phenolic, polyester, or epoxy. It will bond with less strength to brass, copper, and lead. It is not recommended for nickel, tin, zinc, or thermoplastics such as polyethylene. Proper surface treatment is necessary for all bonds.

6.2 Ordering data. Purchasers should select the preferred options permitted herein and include the following information in procurement documents:

- (a) Title, number, and date of this specification.
- (b) Size of kits and type of containers required (see 5.1).
- (c) Quantity required.
- (d) Level of packaging and packing required (see 5.1 and 5.2).
- (e) Thinner required (see 3.1.3).
- (f) Marking required by contract or order (see 5.3).

MILITARY INTERESTS

Custodians:

Army - MR
Navy - AS
Air Force - 84

Review Activities:

Army - MR, MV

User Activities:

ARM - MV, WC
AF - DS, MC

Coordinating Activity:

ARM - AS

PREPARING ACTIVITY. GSA - FSS

Orders for this publication are to be placed with General Services Administration, acting as an agent for the Superintendent of Documents. See Section 2 of this specification to obtain extra copies and other documents referenced herein. Price 10 cents each.