MIL-A-8576C
13 November 1984
SUPERSEDING
MIL-A-8576B
22 September 1965

MILITARY SPECIFICATION

ADHESIVE, ACRYLIC BASE, FOR ACRYLIC PLASTIC

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

1 SCOPE

1.1 Scope This specification covers acrylic-monomer base adhesives intended for use in bonding acrylic plastics.

1 2 Classification The adhesive shall be furnished in the following types, as specified (see 6.2).

Type I - Solvent type
Type II - Non-solvent, high viscosity
Type III - Non-solvent, medium viscosity

2 APPLICABLE DOCUMENTS

2.1 Government documents

2 1.1 Specifications, standards, and handbooks Unless otherwise specified, 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 specification form a part of this specification to the extent specified herein.

SPECIFICATIONS

FEDERAL

PPP-B-585 Box, Wood, Wirebound

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to Systems Engineering and Standardization Department (Code 93), Naval Air Engineering Center, Lakehurst, NJ 08733, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

SPECIFICATIONS (continued)

FEDERAL (continued)

PPP-B-601	Box, Wood, Cleated-Plywood
PPP-B-621	Box, Wood, Nailed and Lock-Corner
PPP-B-636	Box, Shipping, Fiberboard
PPP-B-640	Box, Fiberboard, Corrugated, Triple-Wall
PPP-C-96	Can, Metal, 28 Gage and Lighter
PPP-T-60	Tape, Packaging, Waterproof

MILITARY

MIL-P-5425	Plastic, Sheet, Acrylic, Heat Resistant
MIL-P-8184	Plastic Sheet, Acrylic, Modified
MIL-L-10547	Liner, Case and Sheet, Overwrap, Watervaporproof or Waterproof, Flexible

STANDARDS

MILITARY

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

2 1 2 Other Government documents, drawings, and publications. The following other Government documents, drawings, and publications form a part of this specification to the extent specified herein

CODE OF FEDERAL REGULATIONS

49 CFR 100-178 - Regulations for the Transportation of Explosive and Other Dangerous Articles

(Applications for copies should be addressed to the Superintendent of Documents, Government Printing Office, Washington, DC 20370)

(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.)

2.2 Other publications. The following documents form a part of this specification to the extent specified herein The issues of the documents which are indicated as DoD adopted shall be the issue listed in the current DoDISS and supplement thereto, if applicable

NATIONAL MOTOR FREIGHT TRAFFIC ASSOCIATION, INC , AGENT

National. Motor Freight Classification

(Application for copies should be addressed to the National Motor Freight Traffic Association, Tariff Order Section, 1616 P Street, N W., Washington, DC 20036.)

UNIFORM CLASSIFICATION COMMITTEE, AGENT

Uniform Freight Classification Rules

(Applications for copies should be addressed to the Uniform Classification Committee, Room 1106, 222 South Riverside Plaza, Chicago, IL 60606)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D1545	Viscosity of Transparent Liquids by Bubble Time Method
ASTM D1747	Refractive Index of Viscous Materials

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

(Industry association specifications and standards are generally available for reference from libraries They are also distributed among technical groups and using Federal agencies.)

2 3 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 Materials The adhesive shall consist of a containerized kit with individually packaged components described herein.

3 1 1 Base resin

3 1 1 Type I Type I shall consist of methyl-methacrylate monomer with a suitable polymerization retarder and a suitable solvent

3.1 1 2 Types II and III Types II and III shall consist of a methyl-methacrylate monomer with a suitable polymerization retarder only.

3 1 2 Promoter Type II adhesive kits shall contain a suitable polymerization promoter compound. The promoter shall be added to the base resin and thoroughly mixed, prior to adding the catalyst

3.1.3 Catalyst. The catalyst shall be a suitable compound for all types furnished in sufficient quantity to counteract the polymerization retarder and complete the base resin polymerization

3 2 Appearance The base resin shall be colorless and transparent. It shall not be darker than the standard specified in 4.5.1.1.

3 3 Visual examination of bond The bonded face joint, when prepared as specified in 4 5 2 shall show no cracking, internal defects loose area, or air bubbles in more than 10 percent of the bonded area.

3 4 Mechanical properties The bonded joints shall meet the requirements of table I when tested in accordance with the applicable paragraphs of Section 4

3 5 Physical properties of base resin The base resin shall meet the requirements of table II when tested in accordance with the applicable paragraph specified in Section 4.

3 6 Condition of container after heat stability test. The containers of type I base resin, type II base resin and promoter, and type III base resin shall not break or rupture as a result of the heat stability test procedure (see 4 5 7)

3 7 Manufacturer's instructions Instructions for use of the adhesive shall be included in the marking of each container (see 5.3 1) These instructions shall include:

a Treatment of the acrylic surface prior to application of the adhesive

b Mixing instructions, including thinning to proper viscosity if necessary, and working life of the mixed adhesive

c Allowable temperatures during and following mixing of the adhesive

d Application instructions, including spread method, number of coats, spread rate, film thickness and drying intervals between coats and before joining the surfaces to be bonded and the method of joining the two surfaces

e Recommended time, temperature, and pressure for the complete curing cycle.

3 8 Storage life Type I adhesive shall have a 1 year storage life when stored in its original, unopened container at standard conditions. Types II and III shall be capable of being stored for 6 months at the same conditions Upon completion of the storage period, the adhesive shall be in conformance with the requirements in table I and the "as received" section of table II.

3.9 Workmanship The adhesive components shall be processed in a manner that will insure a product meeting all the requirements of this specification

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 the prescribed requirements

4.1 1 Certificate of compliance When certificates of compliance are submitted, the Government reserves the right to check test such items to determine the validity of the certification

4 2 Classification of inspection The inspection requirements specified herein are classified as quality conformance (see 4 3).

4 3 Quality conformance

4.3.1 Lot formation. Unless otherwise specified herein, a lot shall consist of a maximum of 500 pints, individually packed, or any lesser quantity required by contract, either individually or bulk packed, from a single production batch of base adhesive along with necessary catalyst and promoter, as required, and submitted for acceptance at the same time and place

4 3 2 Sampling for quality conformance

4.3 2 1 For physical tests Quality conformance test samples shall consist of two containers of adhesive selected at random from each lot submitted for inspection. The samples shall include catalyst and promoter, when applicable The sample shall be tested to all the requirements specified in table III. Failure of any specimen to conform with the requirements stated therein shall be cause to reject the lot represented by the sample

4 3 2 2 Sampling for visual inspection A random sample of filled containers shall be selected from each lot in accordance with MIL-STD-105, Inspection Level I and Acceptable Quality Level (AQL) of 2 5 percent defective The sample unit shall be one container. The sample selected shall be inspected to the requirements of table IV.

4.3.2.3 Sampling for packaging The lot size for purposes of this inspection shall be the number of shipping containers The sample unit shall be one shipping container. The sample size shall be determined using Inspection Level I of MIL-STD-105 The Acceptable Quality Level shall be 2 5 percent defective Inspection shall be in accordance with table V and section 5.

4.4 Test conditions. Unless otherwise specified, all tests shall be conducted at a temperature of 25° ± 1 1°C (77° ± 2°F) and a relative humidity of 50 ± 4 percent.

4 5 Test methods.

4 5 1 Appearance A sample of adhesive (base resin) shall be poured from a freshly opened container into a standard Nessler tube and compared for color with an equal volume of color standard contained in a similar Nessler tube The color comparison shall be in daylight quality illumination equal to I C I illuminant "C" (see 6 5).

4 5 1.1 Preparation of color standard 0 1246 gram of Chemically Pure (CP) potassium platinic chloride (K_2 PT Cl_6) and 0 1000 gram of CP potassium cobalt chloride ($CoCl_2$ $6H_2O$) shall be weighed on an analytical balance and dissolved in about 75 milliliters (mls) of distilled water in a 100 ml volumetric flask Ten mls of hydrochloric acid (sp gr 1.19) shall be slowly added, and the solution shall be diluted to the 100 ml mark with distilled water Five mls of this solution shall be pipetted into a 50 ml volumetric flask Distilled water shall be added to the 50 ml mark, and this solution shall be used as the color standard The color standard solution is suitable for use for approximately 6 months after preparation when properly stored

4 5.2 Visual examination of bond

4 5 2 1 Preparation of specimens for type I Two pieces of plastic conforming to specification MIL-P-5425, each 0 125 by 1.5 by 4 inches shall be bonded face to face The manufacturer's instructions for use (see paragraph 3 7) shall be followed However, the soaking period or time of application of the adhesive shall not exceed 15 minutes

4 5.2 2 Preparation of specimens for type II and type III Two pieces of plastic conforming to MIL-P-8184, each 0 250 by 1 5 by 4 inches, shall be bonded face to face for type II and type III The manufacturer's instructions for use (see 3 7) shall be followed No soaking period shall be permitted

4.5.2 3 Examination of specimens The bonded assembly shall remain under the pressure recommended by the manufacturer for a period of 4 hours at standard test conditions Upon removal of the pressure, the bonded area shall be visually examined with the unaided eye in a direction perpendicular to the plane of the bonded piece (see 3 3)

4 5 3 Bonding strength.

4 5.3 1 Preparation of specimens Three bonded assemblies shall be prepared from plastic conforming to MIL-P-5425 for type I, and three bonded assemblies each of MIL-P-8184 for type II and type III, by bonding the long edges of two, 0 250 by 6 by 13 inch sections of plastic to form a butt joint. Adhesive from a freshly opened container shall be prepared, mixed, and applied in accordance with the manufacturer's instructons for use printed on the container However, for type I the soaking period or time of application of the adhesive to the parts to be joined shall not exceed 15 $\pm$ 1 minutes The bonded joints shall remain under the recommended pressure at standard conditions for a period of at least 12 hours prior to the conditioning period specified in 4 5 3 2

4 5.3.2 Conditioning of bonded assemblies.

4 5.3 2 1 Standard conditions. One of the 12-by 13-inch bond assemblies shall be conditioned at standard laboratory conditions for at least 96 hours prior to preparation of the specimens Ten individual specimens conforming to figure 1 shall then be carefully sawed from the bonded assembly, stored, and tested for bond strength under the same conditions on the seventh day after bonding (see table I).

4 5.3.2.2 At elevated conditions. Two of the 12-by 13-inch bonded assemblies shall be conditioned at 70° ± 1 1°C (158° ± 2°F), starting within 15 minutes of manufacture of the joint. Type I shall be heat treated 48 hours; Types II and III assemblies for 24 hours. The bonded assembly shall then be cooled at a rate of not more than 28°C (82°F) per hour and then maintained at standard laboratory conditions for at least 4 hours prior to preparation of the individual specimens Ten specimens conforming to figure 1 shall be carefully sawed from one bonded assembly and tested at standard conditions Ten specimens conforming to figure 1 shall then be carefully sawed from the other bonded assembly, reheated in the test chamber at 70° ± 1.1°C (158° ± 2°F) for a period of between 30 and 45 minutes, and tested for bond strength at the elevated temperature

4 5.3 3 Test procedures. The specimens shall be tested in a tensile strength testing machine which is accurate to within 1 percent of the load to be applied, has self-aligning grips, and is of suitable capacity The rate of head travel under load shall not exceed 0 05 inch per minute. The load at the instant the bond is ruptured shall be recorded to the nearest five pounds The dimensions of the cross-sectional area shall be measured to within 0.5 percent The tensile bonding strength shall be calculated from the following formula

$$\text{Bonding strength} = \frac{L}{A}$$

Where L = Load in pounds
A = Total cross-sectional area in square inches

4 5.4 Index of refraction The index of refraction of the base resin for yellow light (sodium D) shall be determined in accordance with ASTM D1747 Care shall be exercised to insure that the measurement is made on the base resin rather than on the residue after evaporation The instrument shall be cleaned with dichloromethane after use

4 5.5 Specific gravity The specific gravity of the base resin shall be determined by means of suitable hydrometer accurate to 0.01 within its range and readable to 0 01

4 5 6 Viscosity The viscosity of the base resin shall be measured with a Gardner bubble tube in accordance with ASTM D1545.

4 5 7 Heat stability. One original unopened sample container of base resin and promoter shall be kept for a period of 1 week in circulating air oven maintained at a temperature of 50° ± 1.1°C (122° ± 2°F). Upon removal, the containers shall be permitted to cool and shall be examined for breakage

or rupture. Each container shall then be opened and visually inspected for any evidence of deterioration The viscosity of the base resin shall be determined In addition, for type II and type III, the specific gravity of the base resin shall be determined

5. PACKAGING

5 1 Preservation Each of the three types of adhesives with their mixing ingredients shall form a kit that shall be preserved Level A or Level C.

5.1 1 Level A

5 1 1 1 Base resin. The base resin for each of the three kits shall be preserved in one pint or one quart or one gallon dark colored bottles or jars or lacquer-lined can as specified (see 6 2.1). All containers shall meet the heat stability requirements of the specification Bottles and jars shall be standard commercial quality, having metal screw caps with inner seals capable of making a solvent tight closure The seals of the caps shall not contaminate nor be affected by the contents Cans shall conform to PPP-C-96, type V, class 4 The cans shall be lacquer lined, have screw cap closures and contain inner metal friction seals Terneplate cans shall not be used All caps shall be secured with a plastic bonding tape.

5 1 1 2 Promoter Type II promoter ingredient shall be preserved as the base resin (see 5.1 1.1).

5 1 1 3 Catalyst The catalyst for each of the three kits shall be preserved as the base resin (see 5 1 1 1) The catalyst in capsule form shall be of good commercial quality and shall be material that is compatible with the catalyst. The capsules shall also be insoluble in the adhesive

5.1 1 4 Kits. The base resin and catalyst containers for types I and III kits, individually wrapped in a cushioning material, shall be placed in a two-compartment, form-fitting fiberboard box The base resin, catalyst and promoter containers for type II, individually wrapped in a cushioning material, shall be placed in a three-compartment form-fitting fiberboard box Each kit shall contain a kit contents list prepared as indicated in MIL-STD-129

5 1 2 Level C Kits prepared for Level C shall be unit packed in a manner that will afford adequate protection against deterioration and physical damage Particular attention must be given to the preservation of the contents of type II kit to prevent accidental contact between the catalyst and the promoter. Containers shall be those required by the Code of Federal Regulations, 49CFR, Parts 100-178 The containers selected shall be of a design that permits the contents to be readily removed

5 2 Packing. Packing shall be Level A, B or C as specified (see 6.2 1)

5.2 1 Level A The unit pack kits shall be packed in overseas type shipping containers meeting PPP-B-585, PPP-B-601 or PPP-B-621. As far as practical, exterior containers shall be of uniform shape and size, be of minimum cube and tare consistent with the protection requirements, and contain identical quantities The gross weight of each container shall be limited to

approximately 200 pounds. Containers shall be closed and strapped in accordance with the applicable container specification or appendix thereto Containers shall be provided with a case liner conforming to specification MIL-L-10547 and shall be sealed in accordance with the appendix thereto

5 2 2 Level B Unit pack kits shall be packed in weather-resistant containers meeting PPP-B-636 or PPP-B-640 Exterior containers shall be of minimum cube and tare consistent with the protection required. As far as practical, exterior containers shall be of uniform shape and size and contain identical quantities The gross weight of each pack shall be limited to approximately 200 pounds Containers shall be closed and strapped in accordance with the applicable container specification or appendix thereto

5.2 3 Level C The unit pack kits shall be packed in shipping containers in a manner that will afford adequate protection, at the lowest rate, against damage during direct shipment from the supply source to the first receiving activity The containers shall conform to the National Motor Freight Classification or the Uniform Freight Classification rules and regulations for the mode of transportation utilized

5 3 Marking for shipment and storage. Interior packages and exterior shipping containers shall be marked in accordance with MIL-STD-129 The nomenclature shall be as follows:

Adhesive, Acrylic Base, for Acrylic Plastic;
MIL-A-8576C Type (as applicable)

5 3 1 Additional marking The following marking shall also be added

USE: THIS ADHESIVE IS INTENDED FOR USE IN BONDING CERTAIN TYPES OF ACRYLIC PLASTIC.

WARNING· FLAMMABLE AND TOXIC, PROVIDE ADEQUATE VENTILATION, AVOID SKIN CONTACT AND BREATHING VAPORS.

STORE IN A COOL PLACE, UNDER NO CIRCUMSTANCES ABOVE 140° F.

Storage Instructions· This adhesive shall be stored in a cool place The container for the adhesive shall be kept tightly closed. The adhesive shall be issued from stock on a basis of "first in - first out" to prevent adhesive being rendered useless by deterioration resulting from excessive time in storage If the adhesive is not used within 6 months from the date of manufacture, it shall be inspected and tested before use

MANUFACTURER'S INSTRUCTIONS FOR USE: (see 3.7)

6 NOTES

6 1 Intended use.

6 1 1 Type I. This adhesive is intended for use in bonding acrylic plastic conforming to specification MIL-P-5425 and may be used with suitable precautions in bonding other acrylics Under no circumstances should it be used for bonding material conforming to specification MIL-P-8184. This adhesive is a solvent type and is more appropriate to bonding areas when the cushion technique is applicable

6.1 2 Type II and III This adhesive is intended for use in bonding acrylic plastic conforming to specification MIL-P-8184 and MIL-P-5425. Type II and type III adhesives contain no solvent, are self polymerizing, and are more applicable where the cushion technique is not necessary.

6.2 Ordering data

6.2 1 Acquisition requirements Acquisition documents should specify the following.

a Title, number and date of this specification
b Type and capacity of containers
c The quantity desired
d Applicable levels of preservation and packing (see section 5)

6 3 Military personnel should refer to Engineering Handbook T O 1-1A-12, "Fabrication, Maintenance, and Repair of Transparent Plastics," prior to use of the adhesive

6 4 Handling precautions. The adhesive and its vapors are toxic and flammable Precautions should be taken accordingly

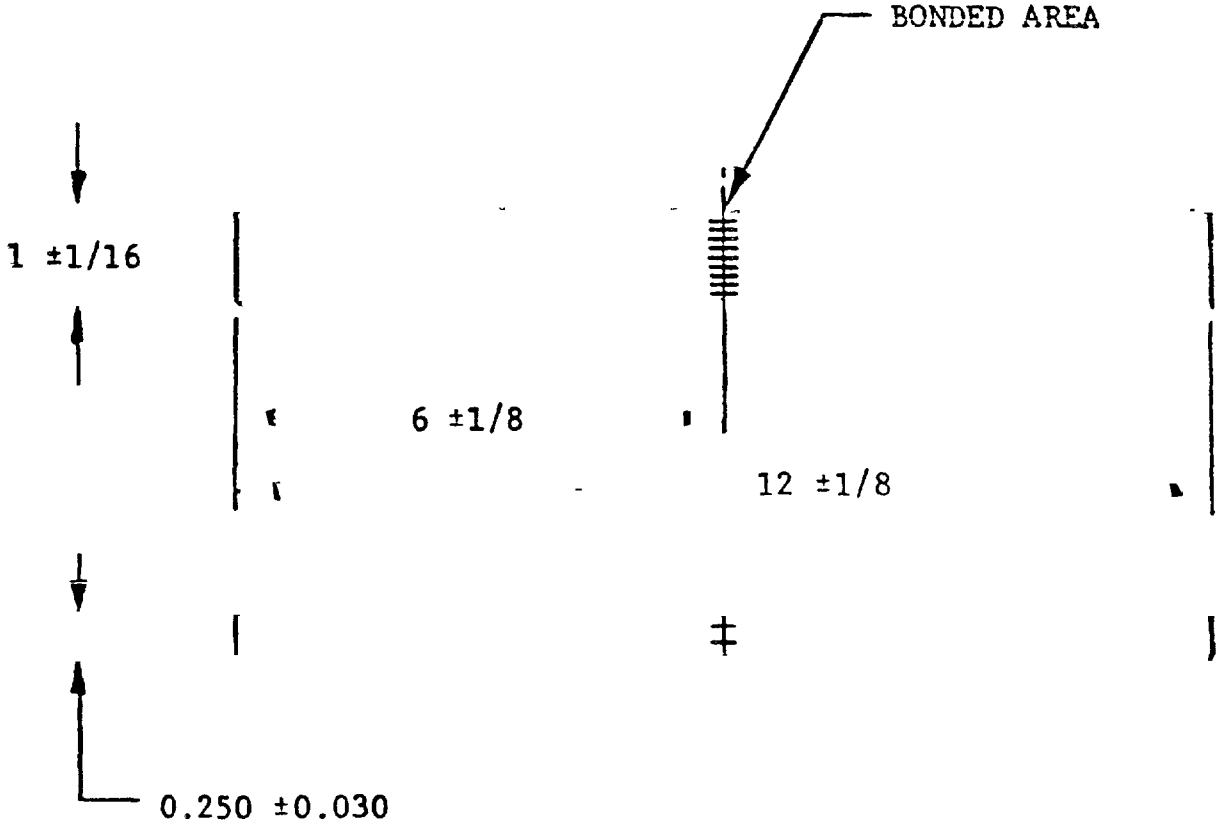
6 5 Changes from previous issue. Asterisks are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes

Custodians
Army - MR
Navy - AS
Air Force - 99

Review Activities
Army - MD, MI

User Activities
Army - ER, ME
Navy - MC

Preparing Activity
Navy - AS
Project No 8040-0432



DIMENSIONS IN INCHES

FIGURE 1. Tensile bonding strength specimen.

Table I Mechanical properties

Property	Requirement 1/ Type I Avg Value 2/	Type I Ind Value Min.	Types II and III Avg Value 2/	Types II and III Ind Value Min.
Tensile strength of bonded butt joints, psi min				
Standard conditions (4 4)	1800	1500	2700	2300
Heat treat 70°C (158°F) for				
a 48 hours, tested at:				
Standard conditions (4 4)	5000	4000	--	--
70°C (158°F)	2400	2000	--	--
b 24 hours, tested at:				
Standard conditions (4 4)	--	--	3100	2300
70°C (158°F)	--	--	2700	2000

1/ A "--" indicates not applicable to that type
2/ Average value of ten specimens

Table II Physical properties of base resin

Property	Requirement Type I	Type II	Type III	Test para
As received				
Index of refraction @ 25°C (77°F)	1 413 to 1 419	1.442 to 1 445	1 439 to 1 443	4 5 4
Specific gravity @ 25°C (77°F)	1 165 to 1 185	1 03 to 1 04	1 02 to 1 04	4 5 5
Viscosity @ 25°C (77°F), approx stokes	1 0 max	17 6 to 36 2	13 2 to 27 6	4 5 6
After heat stability				
Specific gravity @ 25°C (77°F)	1 16 to 1 18	---	--	4.5 5
Viscosity @ 25°C (77°F), approx stokes	4 0 max	17 6 to 36 2	13 2 to 27 6	4 5 6

Table III. Quality conformance physical tests.

Property	Requirement paragraph	Test paragraph
Appearance	3.2	4.5.1
Visual examination of bond	3.3	4.5.2
Bond strength	Table I	4.5.3
Index of refraction	Table II	4.5.4
Specific gravity	Table II	4 5.5
Viscosity	Table II	4.5.6
Heat stability	3.6	4.5.7
Storage stability	3.8	1/

1/ The supplier shall certify to this requirement (see 4.1.1).

Table IV Visual inspection

Inspection	Defect
Adhesive	Contains foreign matter, not of uniform appearance or consistency
Unit container	Improper type, size, closure improper fill

Table V. Packaging inspection.

Inspection	Defect
Intermediate container	Improper separation of components, catalyst container not properly attached to base resin container, packing material omitted or wrong type Improper closure
Packing	Wrong packing specifications, weight too heavy, improper closure
Marking and instruction	Marking wrong or omitted, instruction sheet missing

INSTRUCTIONS In a continuing effort to make our standardization documents better, the DoD provides this form for use in submitting comments and suggestions for improvements All users of military standardization documents are invited to provide suggestions This form may be detached, folded along the lines indicated, taped along the loose edge *(DO NOT STAPLE)*, and mailed In block 5 be as specific as possible about particular problem areas such as wording which required interpretation, was too rigid, restrictive, loose, ambiguous, or was incompatible, and give proposed wording changes which would alleviate the problems Enter in block 6 any remarks not related to a specific paragraph of the document If block 7 is filled out, an acknowledgement will be mailed to you within 30 days to let you know that your comments were received and are being considered

NOTE This form may not be used to request copies of documents, nor to request waivers, deviations, or clarification of specification 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

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Commanding Officer
Naval Air Engineering Center
Engineering Specifications and Standards Department
(ESSD), Code 93
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STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions - Reverse Side)

1. DOCUMENT NUMBER
MIL-A-8576C

2. DOCUMENT TITLE
ADHESIVE, ACRYLIC BASE, FOR ACRYLIC PLASTIC

3a. NAME OF SUBMITTING ORGANIZATION

b. ADDRESS (Street, City, State, ZIP Code)

4. TYPE OF ORGANIZATION (Mark one)

- [ ] VENDOR
- [ ] USER
- [ ] MANUFACTURER
- [ ] OTHER (Specify)

5. PROBLEM AREAS

a. Paragraph Number and Wording

b. Recommended Wording

c. Reason/Rationale for Recommendation

6. REMARKS

7a. NAME OF SUBMITTER (Last, First, MI) – Optional

b. WORK TELEPHONE NUMBER (Include Area Code) – Optional

c. MAILING ADDRESS (Street, City, State, ZIP Code) – Optional

8. DATE OF SUBMISSION (YYMMDD)