

MMM-A-188C
January 2, 1975
SUPERSEDING
Fed. Spec. MMM-A-188B
November 8, 1960

FEDERAL SPECIFICATION

ADHESIVE; UREA-RESIN-TYPE (LIQUID AND POWDER)

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

1. SCOPE AND CLASSIFICATION

1.1 Scope. This specification covers an urea-formaldehyde thermosetting resin adhesive for the assembly gluing of wood items and the bonding of plastic laminate sheets to plywood.

1.2 Classification.

1.2.1 Types and grade. Urea resin adhesive shall be furnished in one grade and the following types, as specified (see 6. 2):

- Type I - Powder (with separate curing agent).
- II - Powder (with incorporated curing agent).
- III - Liquid (with separate curing agent).

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:

- PPP-B-636 - Boxes, Shipping. Fiberboard.
- PPP-C-96 - Cans, Metal, 28 Gage and Lighter.
- PPP-D-705 - Drum, Metal Shipping, Steel (Over 12 and under 55 Gallon).
- PPP-D-723 - Drums, Fiber.
- PPP-D-729 - Drums, Shipping and Storage, Steel, 55-Gallon.
- PPP-P-704 - Pails, Metal: (Shipping, Steel 1 through 12 Gallon).
- PPP-P-1655- Pail, Plastic, Shipping and Storage.

Federal Standards:

- Fed. Std. No. 123 - Marking for Domestic Shipment (Civil Agencies).

(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 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, Fort 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 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 a specific issue is identified, the issue in effect on date of invitation for bids or request for proposal.

American Society for Testing and Materials (ASTM) Standards:

- D 905 - Strength Properties of Adhesive Bonds in Shear by Comparison Loading.
- D 906 - Strength Properties of Adhesive in Plywood Type Construction in Shear by Tension Loading.
- D 1151 - Effect of Moisture and Temperature on Adhesive Bonds.
- D 1489 - Nonvolatile Content of Aqueous Adhesives.
- D 1583 - Hydrogen Ion Concentration of Dry Adhesive Films.

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

National Motor Freight Traffic Association, Inc., Agent:

National Motor Freight Classification.

(Application for copies should be addressed to the American Trucking Association, Inc., Tariff Order Section, 1616 P Street, N.W., Washington, DC 20036.)

Uniform Classification Committee, Agent:

Uniform Freight Classification.

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

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

3. REQUIREMENTS

3.1 Material. The materials, including resins, used in the manufacture of the adhesive shall be such as to produce finished adhesive conforming to this specification.

3.1.1 Unit quantity. Where components, such as curing agent or filler, or both (see 3.2 and 3.5), are furnished separately, the unit quantity of the adhesive furnished under this specification shall be the sum of the individual components.

3.2 Curing agent. The curing agent supplied with the two part urea-resin-adhesive shall readily disperse in the adhesive mixture and shall be used in accordance with the manufacturer's, recommendations.

3.3 Mixing properties. The adhesive shall be readily dispersed or dissolved when mixed with water and shall remain in a homogeneous condition during the entire working life when tested as specified in 4.4.5.

3.4 Insoluble matter. The quantity of insoluble matter, including filler and any insoluble partially polymerized resin, shall be not more than 20 percent of the nonvolatile constituents of the adhesive when mixed and ready to use, when determined as specified in 4.4.2 (see 4.4.1).

3.5 Filler. Where filler is used, it shall be an inert insoluble organic or inorganic substance (powder) incapable of being dissolved or being swelled excessively by water and shall not settle from the adhesive during the working life (see 4.4.5). The filler may be combined with the resin or supplied separately. The amount of filler in the resin, when prepared for use, shall be limited to 20 percent of the nonvolatile constituents (see 4.4.2). Amylaceous fillers such as flour or starch and protein fillers will not be permitted (see 4.4.3).

3.6 pH. When tested in accordance with 4.4.4, the set adhesive film shall develop a pH of not less than 2.5.

3.7 Working life. Unless otherwise specified (see 6.2), the adhesive shall have a minimum working life of 2 hours and a maximum of 8 hours at 75 deg. +/- 5 F deg. (21.1 to 26.7 deg. C) (see 4.4.5).

3.8 Shear strength by compression loading (block shear strength). The adhesive shall develop an average strength of not less than 2800 pounds per square inch, when tested as specified in 4.4.6.

3.9 Shear strength by tension loading (plywood shear strength).

3.9.1 Dry. The adhesive shall develop an average shear strength of not less than 340 p.s.i. when tested as specified in 4.4.7.2.

3.9.2 Wet. The adhesive shall develop an average shear strength of not less than 280 p.s.i. when tested as specified in 4.4.7.3.

3.10 Use instructions. Each shipment of adhesive shall be accompanied by printed instructions which detail proper use of the adhesive.

3.11 Storage stability. The adhesive as furnished by the manufacturer shall be capable of meeting the requirements of 3.6, 3.7, 3.8 and 3.9 after being stored under the conditions specified in 4.4.8 for 2 years from date of manufacture.

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 that supplies and services conform to prescribed requirements.

4.2 Sampling for lot acceptance.

4.2.1 Lot. A lot shall consist of material of one type, manufactured at one place from the same batch or blend of adhesive, subjected to the same processing operations and conditions, and offered for delivery at one time.

4.2.2 Sampling for inspection of filled containers. A random sample of filled containers shall be taken from each lot in accordance with MIL-STD-105 at Inspection Level I and an Acceptance Quality Level (AQL) or 2.5 percent defective to verify compliance with all stipulations of this specification regarding fill, closure, marking, and other requirements not involving tests.

4.2.3 Sampling for tests. Two containers shall be taken at random from each lot. From each of the two containers, one quart specimens and sufficient quantity of curing agent shall be taken and placed in a separate, clean, dry container sealed, marked and forwarded to the testing laboratory designated by the bureau or agency concerned.

4.2.4 For productions check test (at a laboratory designated by the procuring activity concerned). From the first lot offered for delivery and from each other lot in the first ten offered for delivery and one lot in each ten thereafter, a one-quart sample of adhesive shall be taken, and a sufficient quantity of curing

agency to perform the tests specified in 4.3.3 and forwarded to the laboratory designated by the procuring activity concerned. One half of the sample shall be tested and the other half held below 80 deg. F (26.7 deg. F) for additional tests, if necessary. Each container shall be properly labeled with the contract or order number and such additional information as considered necessary to identify the material which the sample represents. Samples for additional tests need not be held for a period longer than 60 days.

4.3 Inspection.

4.3.1 Inspection of filled containers. Each sample filled container selected in accordance with 4.2.2 shall be examined for defects of the container and the closure, for evidence of leakage and for unsatisfactory markings; each sample filled container shall also be weighed to determine the amount of the contents. Any container in the sample, having one or more defeats or under the required fill shall be rejected and 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 Lot acceptance tests. The sample specimen selected in accordance with 4.2.3 shall be subjected to the tests separately specified in 4.4. Except as hereinafter specified, acceptance and rejection of lots shall normally be on the basis of sampling, inspection, and tests of 4.2.3 and 4.3.1. Unless other action is considered desirable, acceptance shall not be withheld pending receipt of test reports on production check test samples. However, upon receipt of an unsatisfactory test report on a production check test sample, additional samples from every subsequent lot offered for delivery shall be selected. The samples so selected shall be submitted to a laboratory designated by the procuring activity concerned and shall there be subjected to the tests wherein failure was observed. Lots shall then be accepted only upon receipt of a satisfactory test report on the samples so selected. This additional testing shall be discontinued and lot acceptance returned to the normal procedures of 4.2.4, 4.3.1, and 4.3.2 when four successive lots have been accepted. The requirements and provisions listed therein shall not be applicable to the Department of the Army procurement.

4.4 Test procedures.

4.4.1 Nonvolatile content. About 100 grams of adhesive shall be mixed with water in accordance with the sellers instructions and tested as specified in ASTM Method D 1489.

4.4.2 Insoluble matter (filler content). This determination shall be made on the same batch of mixed adhesive used for determination of nonvolatile content (see 4.4.1). Approximately 2 grams of the freshly mixed adhesive shall be weighed to the nearest milligram in a 100 ml. beaker, and 50 ml. of a cold solution, made of 20 parts of glacial acetic acid and 80 parts of distilled water, by volume, shall be added. The mixture shall be thoroughly stirred for 1 minute and then 0.500 gram accurately weighed diatomaceous earth ("Filer-Cel" and "Celite Analytical Filter-Aid" have been found satisfactory) which has been previously acid-washed and oven dried to a constant weight at 250 deg. to 260 deg. F (121.1 deg. to 126.7 deg. C) and cooled in a desiccator, shall be added. The mixture shall be stirred for 2 more minutes and then filtered through a previously sintered glass crucible of medium porosity. All residue shall be transferred to the filter with a 20 percent acetic acid solution. The residue on the filter shall be washed with at least 50 ml. of 20 percent acetic acid, and then with cold distilled water, to remove the acid. After preliminary drying by suction, the crucible shall be dried in an oven at 250 deg. to 260 deg. F (121.1 deg. to 126.7 deg. C) for 1 to 1-1/2 hours, cooled in a desiccator, and weighed to the nearest milligram. The insoluble content, as a percent of the nonvolatile content shall be calculated as follows:

$$\frac{\text{Percent insoluble} \\ (\text{Weight of residue} - 0.500) \times 100 \times 100}{(\text{weight or adhesive} \times \text{percent nonvolatile})}$$

4.4.3 Amylaceous matter. One drop of a solution made of 5 grams of iodine, 5 grams of potassium iodide, and 100 ml. of distilled water shall be added to approximately 1/2 gram of the mixed adhesive on a porcelain spot plate or watch glass. A decided darkening of the mixture of the mixture denote the presence of amylaceous matter.

4.4.4 pH. The adhesive shall be prepared and tested for pH in accordance with ASTM Method D 1583.

4.4.5 Mixing properties and working life. Approximately 200 grams of adhesive shall be mixed in accordance with the manufacturer's instruction in a 600 ml. beaker, provided with a glass stirring rod, and the mixing properties noted. The beaker shall be allowed to stand without cover in air at 75 deg. +/- 5 deg. F (21.1. deg. to 26.7 deg. C). The adhesive shall be stirred frequently

with the rod and the time at which the adhesive is considered to be no longer spreadable shall be noted. At the end of the working life it shall be noted whether the adhesive is in a homogeneous condition. In case of doubt as to whether the adhesive is spreadable, the adhesive shall be tested at 75 deg. +/- 5 deg. F (21.1 deg. to 26.7 deg. C) in a Gardner mobilometer, or equivalent, at uniform intervals, after having been maintained at 75 deg. +/- 5 deg. F (21.1 deg. to 26.7 deg. C) in a 600 ml. breaker which is 3/4 filled with the sample under tests. The adhesive shall be considered at the end of its working life when it reaches a viscosity of 600 poises. If the temperature of the gluing operation is 90 deg. F (32.2 deg. C) or higher, the above test may be conducted at 90 deg. F (32.2 deg. C).

4.4.6 Shear strength by compression loading (block shear strength). The adhesive shall be prepared and tested for shear strength as specified in ASTM Method D 905.

4.4.7 Shear strength by tension loading (plywood shear strength).

4.4.7.1 Preparation of specimens. The adhesive shall be prepared as specified in ASTM Method D 906.

4.4.7.2 Dry shear. The odd numbered specimens shall be conditioned and tested in accordance with ASTM Method D 906.

4.4.7.3 Wet shear. The even numbered specimens shall be conditioned for 48 hours using test exposure number 6 of ASTM Method D 1151 and tested in accordance with ASTM Method D 906.

4.4.8 Storage stability. A suitable amount of adhesive being tested shall be stored in tightly sealed containers for the period specified in 3.11 at temperatures between 32 deg. and 80 deg. F (0 deg. to 26.7 deg. C). At the end of the storage period, the adhesive shall be tested as required in 4.4.4, 4.4.5, 4.4.6 and 4.4.7 for compliance with 3.11. The manufacturer's authorized certification may be accepted in lieu of test data for compliance with 3.11.

5. PREPARATION FOR DELIVERY

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

5.1.1 Level A.

5.1.1.1 Type I and II. The type I resin, and curing agent, or type II adhesive in quantities specified in the contract or purchase order shall be packed in fiber drums conforming to PPP-D-723, type II, grade A. Type II adhesive and when specified type I resin and curing agent in five (5) pound or less quantities shall be furnished in multiple friction top cans conforming to PPP-C-96, type V, class 2. Plan B coating and side seam striping shall be required.

5.1.1.2 Type III. The resin and curing agent in the quantities specified in the contract or purchase order shall be packaged in the following metal containers: (1) the one (1) 1 gallon or smaller containers shall conform to PPP-C-96, Type V, class 2. (2) The five (5) -gallon containers shall conform to PPP-P-704, type II or III, or PPP-P-1655, type I, class 1 or 2, grade GP. (3) The sixteen (16) or thirty (30) gallon container shall conform to PPP-D-705, types I, II, IV or VI. (4) The fifty five (55) gallon container shall conform to PPP-D-729.

5.1.2 Level B.

5.1.2.1 Types I and II. The resin, curing agent or adhesive in quantities specified in the contract or purchase order shall be packaged in fiber or metal containers as specified (see 6.2). The fiber drums shall conform to PPP-D-723, type I class A or E. The metal containers shall conform to PPP-C-96, type V, class 2; PPP-P-704, Type II; PPP-D-705, type I, II, IV, or VI; or PPP-D-729.

5.1.2.2 Type III. The resin or curing agent in the quantities specified in the contract or purchase order shall be packaged in metal containers as specified in 5.1.1.2.

5.1.3 Level C. The resin, curing agent or adhesive shall be packaged in a manner that will afford protection against contamination, deterioration, and loss of content during shipment from the supplier to the initial destination. The supplier may use his commercial package providing it fulfills these requirements. Containers shall comply with the Uniform Freight Classification Rules or National Motor Freights Classification Rules, as applicable.

5.2 Intermediate Packaging.

5.2.1 Type I or type III. Type I or type III resin and curing agent packaged in five (5) pound or one (1) gallon and smaller containers shall have one (1) container of each component (one (1) resin and one (1) curing agent) packaged in

a class-domestic, grade 125, PPP-B-636 box and closed in accordance with the appendix of the box specification.

5.2.2 Type II. Type II adhesive shall not require intermediate packaging.

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

5.3.1 Level A. The resin, curing agent or adhesive packaged in five (5) pound or one (1) gallon and smaller containers shall be packed for shipment in accordance with PPP-C-96 appendix level A. Twenty-five (25) pound, fifty (50) pound, one hundred (100) pound, five (5) gallon and fifty-five (55) gallon containers that meet the requirements of 5.1.1 shall not require over packing.

5.3.2 Level B. The resin, curing agent or adhesive packaged in five (5) pound or one (1) gallon and smaller in accordance with PPP-C-96, appendix level B. Twenty-five (25) pounds, fifty (50) pound, one hundred (100) pound, five (5) gallons and fifty-five (55) gallon containers that meet the requirements of 5.2 shall not require overpacking.

5.3.3 Level C. The resin, curing agent or adhesive shall be packaged to insure carrier acceptance and safe delivery to destination without contamination, deterioration, or loss of content. The containers shall comply with the National Motor Freight Classification, Uniform Freight Classification Rules.

5.4 Marking. In addition to any special marking required by the contract or purchase order, all marking shall be in accordance with 5.4.1 or 5.4.2, as specified (see 6.2) and 5.4.3.

5.4.1 Civil agencies. Marking shall be in accordance with Federal Standard No. 123.

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

5.4.3 Labeling. A label or tag with the following instructions shall be attached to each container.

- (a) The general chemical type of base resin used followed by "unmodified".
- (b) Date of manufacture by month and year.
- (c) First reinspection date (2 years from date of manufacture).
- (d) Brief instruction for mixing of the adhesive and the working life of the mixed adhesive.

6. NOTES

6.1 Intended use. The adhesive covered by this specification is intended for use where moderate water-resistance is required. It is not a fully waterproof adhesive, and is not intended for that purpose.

6.2 Ordering data. Purchasers should exercise any desired options offered herein and procurement documents should specify the following:

- (a) Title, number, and date of this specification.
- (b) Type required (see 1.2).
- (c) Size of container required (see section 5).
- (d) Selection of applicable levels or packaging and packing (see 5.1 and 5.3).
- (e) Marking required (see 5.4.1 and 5.4.2).
- (f) Whether the working life shall be determined at 90 deg. F (see 3.7 and 6.5).

6.3 Storage and handling. Adhesive conforming to this specification should be kept dry, tightly covered, and at a temperature between 32 deg. and 80 deg. F (0 deg. to 26.7 deg. C). Due to the sensitivity of the adhesive to extremes of temperature during shipment, it is recommended that the adhesive be kept out of the sun. If transit and storage conditions necessitate exposure of the adhesive for prolonged period to temperatures in excess of 80 deg. F (26.7 deg. C), it can be expected, in general, that the shelf life of the adhesive will be reduced.

6.4 Adhesives should be purchased by net weight.

6.5 During the summer months it may be advantageous to use an adhesive which has a long working life at the higher ambient temperature. For such application it may be advisable to specify in the procurement document that the adhesive shall have a minimum working life of 2 hours and maximum of 8 hours at 90 deg.

F (32.2 deg. C) (see 3.7).

MILITARY CUSTODIANS:

CIVIL AGENCY COORDINATING ACTIVITY:

User activities

Army-MR
Navy-AS
Air Force-84

Army - MI, MU
Navy - OS, SH

COM-NBS

Preparing activity

GSA-FSS

Orders for this publication are to be placed with the 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 30 cents each.

NOTICE
OF VALIDATION

INCH-POUND

MMM-A-188C
NOTICE 1
30 September 1992

FEDERAL SPECIFICATION

ADHESIVE, UREA-RESIN-TYPE (LIQUID AND POWDER)

MMM-A-188C, dated 02 January 1975, has been reviewed and determined to be valid for use in acquisition.

MILITARY COORDINATING ACTIVITY:
NAVY - AS

CUSTODIAN:
Army - MR
Navy - AS
Air Force - 99