

MMM-A-189C
 18 March 1985
 SUPERSEDING
 MMM-A-189B
 November 12, 1975

FEDERAL SPECIFICATION

ADHESIVE, SYNTHETIC-RUBBER, THERMOPLASTIC, GENERAL-PURPOSE

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 organic-solvent-base synthetic rubber thermoplastic adhesives for general-purpose use (see 6.1).

1.2 Classification.

1.2.1 Classes. Adhesives covered by this specification shall be of the following class as specified (see 6.2).

Class 1 - 20 percent nonvolatile content

Class 2 - 30 percent nonvolatile content (see 6.1)

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-200/3 - Aluminum Alloy Bar, Rod, Shapes, Tubes, and Wire, Extruded, 2024.
- QQ-A-225/6 - Aluminum Alloy Bar, Rod, and Wire; Rolled, Drawn, or Cold Finished, 2024
- QQ-B-620 - Brass, Leaded and Nonleaded: Rod, Shapes, Forgings, and Flat Products with Finished edges (Bar and Strip).
- QQ-S-698 - Steel, Sheet and Strip, Low Carbon.
- TT-T-548 - Toluene, Technical.
- CCC-C-430 - Cloth, Sheeting, Cotton, and Polyester and Cotton.
- PPP-B-566 - Box, Folding, Paperboard.
- PPP-B-665 - Boxes: Paperboard, Metal Edged and Components.
- PPP-B-670 - Boxes, Setup
- PPP-C-96 - Cans, Metal, 28 Gage and Lighter.
- PPP-P-704 - Pails, Metal (Shipping, Steel, 1 through 12 Gallon).

MMM-A-189C

Federal Standards

- Fed. Std. No. 123 - Marking for Shipment (Civil Agencies).
- Fed. Test Method Std. No. 141/GEN - Paint, Varnish, Lacquer and Related Materials; Methods of Inspection, Sampling and Testing.
- Fed. Test Method No. 141/5132 - Chlorinated Compound (Presence of).
- Fed. Test Method No. 141/7356 - Solvent Content of Enamels and Enamel Thinners (Gas Liquid Chromatography).

(Activities outside the Federal Government may obtain copies of Federal specifications, standards, and commercial item descriptions as outlined under general information in the Index of Federal Specifications, Standards and Commercial Item Descriptions. The Index, which includes cumulative bi-monthly supplements as issued, is for sale on a subscription basis by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.)

(Single copies of this specification and other Federal specifications and commercial item descriptions required by activities outside the Federal Government for bidding purposes, are available without charge from the General Services Administration Business Service Centers in Boston, MA, New York, NY, Washington, D.C., Atlanta, GA, Chicago, IL, Kansas City, MO, Fort Worth, TX, Houston, TX, Denver, CO, San Francisco, CA, Los Angeles, CA, and Seattle, WA.)

(Federal Government activities may obtain copies of Federal Standardization, Documents and the Index of Federal Specifications, Standards and Commercial Item Descriptions 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.)

Laws and Regulations:

U.S. Department of Transportation (DOT).

Code of Federal Regulations, Title 49 - Transportation, Parts 100-199 Rules and Regulations for the Transportation of Hazardous Materials.

(The Code of Federal Regulations (CFR) and the Federal Register (FR) are for sale on a subscription basis by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. When indicated, reprints of certain regulations may be obtained from the Federal agency responsible for issuance thereof.)

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.

National Motor Freight Traffic Association, Inc., Agent:

National Motor Freight Classification

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

Uniform Classification Committee,

Uniform Freight Classification

(Application 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)

- D 86 - Test for Distillation of Petroleum Products.
- D 903 - Test for Peel or Stripping Strength of Adhesive Bonds.
- D 1002 - Test for Strength Properties of Adhesives in Shear by Tension Loading (Metal-to-Metal).
- D 1084 - Test Methods for Viscosity of Adhesives.

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

3. REQUIREMENTS

3.1 Materials. The adhesive shall be a thermoplastic synthetic rubber base material dissolved in an organic solvent or blend of solvents, modified to the extent that the requirements of this specification are met (see 4.1.1).

3.1.1 The manufacturer is given latitude in the selection of solvents or blend of solvents, provided the material meets the requirements specified in 3.1.1.1 and 3.1.1.2.

3.1.1.1 The solvent system when tested as specified in 4.3.2.6 shall contain no benzene (benzol) nor halogenated compounds.

3.1.1.2 The volatile solvent when tested as specified in 4.3.2.6 shall conform by volume to the requirements controlling the emission of solvents into the atmosphere as called out in (a), (b), (c), (d), and (e).

- (a) A combination of aldehydes or branched chain ketones: 20 percent maximum.
- (b) A combination of aromatic compounds with eight or more carbon atoms to the molecule except ethylbenzene: 8 percent maximum.
- (c) A combination of ethylbenzene or toluene: 20 percent maximum.
- (d) A combination of solvents with an olefinic or cyclo-olefinic type of unsaturation: 5 percent maximum.
- (e) Total of (a) + (b) + (c) + (d) = 20 percent maximum.

MMM-A-189C

3.2 Condition in container. When tested as specified in 4.2.5 the adhesive shall be homogeneous and intimately compounded and have no other undesirable qualities.

3.3 Specific gravity. The specific gravity of the adhesive shall be not less than 0.80 nor more than 0.98 when tested as specified in 4.3.2.1.

3.4 Viscosity.

3.4.1 Viscosity (class 1). The viscosity of class 1 adhesive shall be not less than 10 seconds nor more than 40 seconds when tested as specified in 4.3.2.2.

3.4.2 Viscosity (class 2). The viscosity of class 2 adhesive shall be not less than 15 seconds nor more than 45 seconds when tested as specified in 4.3.2.2.

3.5 Nonvolatile content. The nonvolatile content of the adhesive when tested as specified in 4.3.2.3 shall be as follows

	Minimum Percent	Maximum Percent
Class 1 (20 percent nonvolatile content)	18	22
Class 2 (30 percent nonvolatile content)	28	32

3.6 Ash content of nonvolatile matter. The ash content of the nonvolatile matter in the adhesive shall not exceed 18 percent when tested in accordance with 4.3.2.4.

3.7 pH of adhesive-water mixture. The pH of a water-adhesive mixture shall be not less than 5.5 nor more than 9.0 when tested in accordance with 4.3.2.5.

3.8 Shear strength. Both classes of adhesive shall conform to the requirements listed in table I when tested in accordance with 4.3.2.8.

TABLE I. Shear Strength

Conditioning time and temperature	Test temperature	Minimum average value, lbs. per sq. inch	Minimum individual value, lbs. per sq. inch
24 hrs. at $25^{\circ} \pm 2^{\circ}\text{C}$ ($77^{\circ} \pm 3.6^{\circ}\text{F}$)	$25^{\circ} \pm 2^{\circ}\text{C}$ ($77^{\circ} \pm 3.6^{\circ}\text{F}$)	1200	1000
24 hrs. at $77^{\circ} \pm 2^{\circ}\text{C}$ ($170.6^{\circ} \pm 3.6^{\circ}\text{F}$), then 2 hrs. at 25°C $\pm 2^{\circ}\text{C}$ ($77^{\circ} \pm 3.6^{\circ}\text{F}$)	$25^{\circ} \pm 2^{\circ}\text{C}$ ($77^{\circ} \pm 3.6^{\circ}\text{F}$)	1200	1000
24 hrs. immersion in toluene at $25^{\circ} \pm 2^{\circ}\text{C}$ ($77^{\circ} \pm 3.6^{\circ}\text{F}$)	$25^{\circ} \pm 2^{\circ}\text{C}$ ($77^{\circ} \pm 3.6^{\circ}\text{F}$)	1000	800
2 hrs. at $50^{\circ} \pm 2^{\circ}\text{C}$ ($122 \pm 3.6^{\circ}\text{F}$)	$50^{\circ} \pm 2^{\circ}\text{C}$ ($122^{\circ} \pm 3.6^{\circ}\text{F}$)	700	500

3.9 Peel strength. The adhesive shall have a minimum peel strength of 12 pounds per inch width and minimum individual value of 10 pounds per inch width when tested in accordance with 4.3.2.8.

3.10 Corrosivity. The adhesive shall not be corrosive to steel, aluminum, or brass when tested in accordance with 4.3.2.9.

3.11 Shelf storage life. When the adhesive is stored as specified in 4.3.2.10 there shall be no gelling, curdling, stringing or other nonuniformity, the viscosity shall not have changed more than 10 percent plus or minus from the originally-specified viscosity (see 3.3), and the strength values shall be not less than the minimums specified in table I (first condition only) and 3.9 (see 4.1.1.).

3.12 Toxicity. 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 procuring agency to the appropriate department medical service who will act as an advisor to the procuring agency. In the case of Army procurement, the Surgeon General of the Army will act as advisor (see 4.3.2.11).

3.13 Compatibility (reactivity and storage characteristics). When compatibility for use with a particular explosive or propellant is required, special tests shall be conducted at a Government laboratory. The procuring agency shall request that these tests be conducted and shall specify the particular explosive or propellant to be used in the tests (see 6.3).

MMM-A-189C

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract, 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 that supplies and services conform to prescribed requirements.

4.1.1 The supplier shall submit to the contracting officer a certificate of compliance indicating that the adhesive complies with the shelf storage life requirement as specified in 3.11. When certificates of compliance are submitted, the Government reserves the right to check test such items to determine the validity of the certificate.

4.2 Quality conformance inspection.

4.2.1 Lot formation. A lot shall consist of adhesive from one batch. A batch is defined as that quantity of material which has been subjected to some unit chemical or physical mixing process intended to make the final product substantially uniform.

4.2.2 Sampling. Sampling of the adhesive shall be performed as directed by the procuring agency either (a) in a thoroughly-mixed batch of adhesive before packaging, or (b) on a lot of packaged adhesives (filled containers). Sampling for preparation for delivery shall be made on the packaged, or packaged and packed lot.

4.2.3 Examination of filled containers. When the examination is to be performed on filled containers, a random sample of such containers shall be selected for examination from each lot in accordance with MIL-STD-105. From these containers 8-ounce samples shall be selected, one from each of two containers, the contents of which appear to have different consistencies. Not less than two samples shall be taken.

4.2.4 Examination of adhesive before packaging. For tests when the sampling is to be performed on the adhesive before packaging, an 8-ounce representative sample shall be selected from each batch.

4.2.5 Condition in container. The condition in the container shall be determined as follows: Each container in the sample shall be opened and sufficient adhesive shall be poured into a clean, dry vessel to permit the remainder of the adhesive to be stirred without spilling. The adhesive shall be stirred with a clean paddle reaching to the bottom of the container. The presence of segregation, caking, lumps, skins or solid particles shall be observed, and differences in consistency between sample units shall be determined by feeling the resistance to movement of the paddle and by observing the material as it drains off the paddle. The material removed shall then be returned to the container.

4.2.6 Disposition of sample. Sample units selected as specified in 4.2.3 and 4.2.4 shall be tested separately for specific gravity (see 3.2) and viscosity (see 3.3) and all portions must pass both tests. If the sample units pass both tests, the remainder of the samples shall be mixed and this composite sample used for the other tests. A portion of this composite sample shall be placed in an airtight container and labeled to show the batch number, the name of the material, manufacturer, plant, contract or purchase order number, date of sampling, and identification mark of samples.

4.2.7 Examination. Sample units selected in accordance with 4.2.3 shall be examined for the defects at the acceptable quality level (AQL) shown in table II. This examination is to determine that the adhesive meets the acceptable quality requirements and the preparation for delivery requirements specified in section 5.

4.3 Tests.

4.3.1 Classification of tests. All tests shall be performed in accordance with 4.1 and shall be classified as follows:

- (a) Periodic lot-check tests (see 4.3.1.1).
- (b) Lot acceptance tests (see 4.3.1.2).

4.3.1.1 Periodic lot-check tests. Periodic lot-check tests shall be performed on the first lot of adhesive offered to the Government against this specification and once on every 20 lots thereafter, or once every 2 years, whichever is the more frequent, and shall consist of all tests of this specification. Whenever a lot is tested and fails to pass one or more of the periodic lot-check tests, either regular or recheck, no further lot will be accepted until the supplier has presented sufficient evidence to show that the cause of the failure has been corrected.

4.3.1.2 Lot acceptance tests. Lot acceptance tests shall be made on each lot of product and shall be the basis for acceptance or rejection of the lot. The lot acceptance tests shall consist of the following tests:

- Specific gravity (see 3.3).
- Viscosity (see 3.4).

MIL-A-189C

TABLE II. Classification of Defects

Material	Classification AQL percent	of major defects	Defect	Method of inspection
Adhesive (see 3.2)	2.5	101	Not intimately compounded.	Visual
		102	Not homogeneous.	Visual
Unit container (see 5.1.1.1, 5.1.2.1 or 5.1.3 as applicable and 5.3 and 5.4)	2.5	103	Improper fill. ^{1/}	Visual and scale ^{2/}
		104	Wrong type or size.	Visual
		105	Leakage.	Visual
		106	Improper closure.	Visual
		107	Marking improper or unidentifiable.	Visual
Intermediate package (if required) (see 5.1.2.2, 5.3 and 5.4)	2.5	108	Wrong number of unit containers	Visual
		109	Wrong type.	Visual
		110	Wrong size.	Visual
		111	Marking improper or unidentifiable.	Visual
Box open (see 5.2.1, 5.2.2 or 5.2.3)	2.5	112	Wrong type or size.	Visual
		113	Lack of, or improper strapping.	Visual
Box closed (see 5.2.1, 5.2.2 or 5.2.3, 5.3 and 5.4)	2.5	114	Gross Weight, maximum.	Approved scale ^{2/}
		115	Improperly closed.	Visual
		116	Marking improper or unidentifiable.	Visual

^{1/} A container filled with the minimum required quantity of adhesive shall be weighed and this weight compared with the weight of unopened containers to determine fill.

^{2/} Approved by procuring agency.

4.3.1.2.1 Certification. Whenever a lot acceptance test is made the supplier shall certify that the lot was made of the same ingredients and by the same process as a previous lot which has passed all tests of the specification. The certificate shall be signed by a responsible agent of the certifying organization and shall be accompanied by evidence of this agent's authority to bind his principal. The Government reserves the right to check-test the adhesive under certification.

4.3.2 Test methods.

4.3.2.1 Specific gravity. The sample shall be thoroughly stirred and the temperature adjusted to $25^{\circ} + 2^{\circ}\text{C}$ ($77^{\circ} + 3.6^{\circ}\text{F}$). The sample shall be poured into a tared 100-milliliter (ml.) graduated cylinder to the 100-ml. level, care being taken to eliminate any air bubbles by tapping the cylinder on a large rubber stopper. The cylinder and contents shall be weighed to the nearest 0.1 gram (g.). The specific gravity shall be calculated by dividing the weight of the sample by 100 to determine compliance with the applicable requirement of 3.3.

4.3.2.2 Viscosity. The viscosity of the adhesive shall be determined in accordance with ASTM D 1084, method A, with consistency cups as follows:

Class	Size of Cup
Class 1	0.15-inch orifice
Class 2	0.25-inch orifice

4.3.2.3 Nonvolatile content. A weighing bottle (approximately 2.25 inches inside diameter and 1.25 inches deep) shall be heated for 1 hour at $100^{\circ} + 5^{\circ}\text{C}$ ($212^{\circ} + 9^{\circ}\text{F}$), then cooled in a desiccator, and weighed. All weighings shall be to the nearest one-hundredth gram (g.). Approximately 20 g. of the sample shall be placed in the prepared weighing bottle, the bottle immediately covered, and weighed. The cover shall be removed, and the weighing bottle placed on a steam bath until most of the solvent has evaporated. (Caution: Care should be taken to remove as much of the solvent as is practicable by this method in order to eliminate any fire hazard which might otherwise exist when the material is subjected to the subsequent drying operation.) The weighing bottle and contents shall then be placed in an oven at $100^{\circ} + 5^{\circ}\text{C}$ ($212^{\circ} + 9^{\circ}\text{F}$) heated for 5 hours, and the original cover replaced. The weighing bottle contents and cover shall then be cooled in a desiccator and weighed. The heating and weighing procedure shall be continued for heating periods of 1/2 hour at $100^{\circ} + 5^{\circ}\text{C}$ ($212^{\circ} + 9^{\circ}\text{F}$) until the loss in weight is less than 0.2 g. The percentage of nonvolatile matter shall be calculated by the following formula to determine compliance with the requirements in 3.5

$$\text{Percent of nonvolatile matter} = \frac{A \times 100}{B}$$

where:

A - weight of sample after heating.

B = weight of sample for determination.

MMM-A-189C

4.3.2.4 Ash content of nonvolatile matter. Approximately 20 g. of the sample shall be placed in a tared, 150-ml. capacity, high-form porcelain crucible. The crucible and contents shall be placed on a steam bath until the solvent has been evaporated. (Caution: Care should be taken to remove as much of the solvent as is practicable by this method in order to eliminate any fire hazard which might otherwise exist when the material is subjected to the subsequent drying operation.) Then the crucible and contents shall be placed in an oven at 100° to 105°C (212° to 221°F) for 5 hours, cooled in a dessicator, and weighed. The weight of the nonvolatile matter in this sample shall be calculated by subtracting the tared weight of the crucible from the combined weight of the nonvolatile matter and the crucible. A 25-ml. portion of concentrated nitric acid shall be added to the crucible containing the dried material. The crucible shall be covered with a watchglass to prevent loss by spattering, and heated on an open steam bath until the vigorous reaction which first ensues has subsided. The addition of 25 ml. of concentrated nitric acid and heating on the steam bath shall be repeated until no solid material remains in the crucible. The watchglass shall be removed, and the crucible and contents continued to be heated on the open steam bath until all excess nitric acid has been removed. The crucible and contents shall then be placed on an electric hotplate, at medium heat, and heated until all volatile matter has been driven off, and the contents of the crucible have been charred. The crucible and contents shall be ignited to constant weight in a muffle furnace at 600° ± 25°C (1112° ± 45°F). The ash content of the nonvolatile matter shall be calculated by means of the following equation to determine compliance with the applicable requirement of 3.6.

$$\text{Percent ash} = \frac{A \times 100}{B}$$

where

A = weight of ash.

B = weight of nonvolatile matter in sample.

4.3.2.5 pH of adhesive-water mixture.

4.3.2.5.1 Preparation of purified water. A 10-g. portion of chromic acid (CrO₃) shall be dissolved in 1000 ml. of distilled water. The solution shall be distilled, the first 100 ml. of the distillate discarded, and the next 600 ml. retained for use.

4.3.2.5.2 Determination of pH. Approximately 10 g of the sample shall be placed in a 100-ml. beaker. Then 50 ml. of the purified water prepared as specified in 4.3.2.5.1 shall be added, the beaker covered with a watchglass, and the mixture allowed to stand at 73.4° ± 3.6°F (23° ± 2°C) for one hour. The mixture shall be stirred every 10 minutes. The electrode of a pH meter (see 6.5) shall be inserted into the beaker so that the mixture of the water and sample covers the active surfaces of the electrodes. The contents of the beaker shall be allowed to remain in contact with the electrodes of the pH meter for 15 minutes before the first measurement is taken. A measurement shall be taken every succeeding 5 minutes until a total of 4 values have been obtained. The pH of the adhesive-water mixture shall be recorded as the average of the 4 values to determine compliance with the applicable requirements in 3.7.

4.3.2.6 Solvent analysis.

4.3.2.6.1 Separation of volatile portion. Separate portion in accordance with method 7355 of Fed. Test Method Std. No. 141.

4.3.2.6.2 Solvent composition. The solvent composition shall be determined in accordance with method 7360 of Fed. Test Method Std. No. 141 and shall comply with the requirements of 3.1.1.

4.3.2.6.2.1 Aromatic and oxygenated solvents. The 6-ft. column shall be installed and the operating conditions described in method 7360 of Fed. Test Method Std. No. 141 shall be followed. About 3 microliters of the isolated distillate shall be injected and the chromatogram scanned. The aliphatic solvents will emerge within 1 minute and the complete chromatogram should develop in about 5 minutes. From the position of the peaks observed on the chromatogram, an internal standard that will be free of interference shall be selected, such as cyclopentanol or cyclohexanol. Six-tenths of a milliliter of internal standard shall be added to 3 milliliters of the distillate. The sample shall be analyzed according to the above procedure. Peaks emerging after 1 minute are aromatic solvents along with any oxygenated solvents that may be present. The percent of aromatic and oxygenated solvents shall be calculated as follows:

$$\% \text{ aromatic and oxygenated solvents, v/v} = \frac{20^* \times A}{1.02^{**} \times B}$$

Where, A = area of aromatic and oxygenated solvents.

B = area of internal standard.

* = percent of internal standard added.

** = correction factor if cyclopentanol is used. If another internal standard is used, calibrate to determine the correction factor.

4.3.2.6.2.2 Halogenated compounds. The presence of halogenated compounds shall be determined in accordance with method 5132 of Fed. Test Method No. 141.

4.3.2.6.2.3 Benzene. When the solvent is tested in accordance with 4.3.2.6.2.1, a trace benzene peak of not more than 2 percent of the toluene peak will be allowed.

4.3.2.7 Shear strength.

4.3.2.7.1 Preparation of shear test specimens. A total of 40 panels shall be prepared from steel conforming to QQ-S-698 grade 1018 or 1020 to measure 1 by 4 by 0.064 inch. One face of each panel shall be thoroughly cleaned by buffing with fine emery cloth. The panels shall be degreased by immersing them in a solution prepared as follows:

Sodium metasilicate or sodium orthosilicate.....	30 grams
Sodium alkylaryl sulfonate.....	3 grams
Water to make.....	1 liter

The panels shall be immersed in this solution for 5 minutes at 60° to 65°C (140° to 149°F) and rinsed with hot, distilled water, then dried in an

MMM-A-189C

oven at 100° to 105°C (212° to 221°F). Using a stiff-bristled brush, a thin coating of the adhesive material shall be applied to one end of each of the panels for a length of about 1-1/4 inches. The adhesive shall be dried in an oven 1 hour at 77° ± 2°C (170.6° ± 3.6°F). Then, the 2 panels shall be placed together so that the adhesive-coated faces are together, and the panels overlap over an area of exactly 1 square inch. The panels shall be bonded by applying and maintaining a pressure of 500 pounds per square inch, and a temperature of 202° to 207°C (396° to 405°F) for 6 ± 1 minute. A hot press shall be used for the bonding.

4.3.2.7.2 Testing of shear specimens. The shear strength tests shall be performed to determine compliance with 3.8. Five of the specimens prepared as specified in 4.3.2.8.1 shall be kept at 20° ± 2°C (77° ± 3.6°F) and 50 ± 4 percent relative humidity for 24 hours and then tested in accordance with ASTM D 1002. A second set of five specimens shall be placed in an oven at 77° ± 2°C (170.6° ± 3.6°F) for 24 hours. They shall be allowed to cool to 25°C ± 2°C (77° ± 3.6°F) and tested as indicated above. A third set of five specimens shall be immersed in toluene complying with the requirements of TT-T-548 at 25° ± 2°C (77° ± 3.6°F) for 24 hours, then wiped dry with a towel and an immediate determination of the shear strength made as indicated above. A fourth set of five specimens shall be placed in a test chamber heated to 50° ± 2°C (112° ± 3.6°F) for 2 hours, and the shear strength determined at this temperature. The average of each set of five specimens shall be calculated and recorded as the sample value. The storage conditions and testing temperatures for each of the four sets of specimens are outlined for convenience as follows:

Storage Condition	Test Temperature
(1) 25° ± 2°C (77° ± 3.6°F) and 50 ± 4% RH - 24 hrs	25°C
(2) 77° ± 2°C (170.6° ± 3.6°F) - 24 hrs	
(3) Immerse in toluene at 77° ± 2°C (170.6° ± 3.6°F) - 24 hrs.	25°C
(4) 50° ± 2°C (112° ± 3.6°F) - 2 hrs	50°C

4.3.2.8 Peel strength.

4.3.2.8.1 Preparation of peel test specimens. Adhesive joint specimens are prepared by bonding flexible (cotton) strips to rigid (steel) panels. A total of 10 panels of cold-rolled steel measuring 1 by 8 by 1/16 inch and a total of 10 strips of cotton cloth conforming to CCC-C-430 and measuring 1 by 12 inches shall be prepared. The steel panels shall be wiped with a clean cloth dampened with acetone, and then thoroughly vapor degreased with perchloroethylene. The panels shall be allowed to cool to 25° ± 2°C (77° ± 3.6°F). Adhesive shall be applied to a 5-inch length of one area of each steel panel, and to a 5-inch length of one side of each cotton cloth strip. The number of coats of adhesive and the drying time between coats shall be as specified by the manufacturer, but no more than 2 coats shall be applied to each faying surface. The adhesive shall not be thinned. All cementing operations shall be made at 25° ± 2°C (77° ± 3.6°F) and

50 \pm 4 percent relative humidity. The bonding surfaces shall be brought together immediately after coating with adhesive. The unbonded ends of the adherends shall be adjacent to each other. Hand pressure shall be maintained to keep the faying surfaces in intimate contact and all wrinkles shall be removed. The specimens shall be air-dried for 18 hours at 25°F \pm 2°C (77° \pm 3.6°F), then dried for 24 hours at 50° \pm 2°C (122° \pm 3.6°F) in an air-circulating oven.

4.3.2.8.2 Testing of peel specimens. The peel specimens prepared in 4.3.2.8.1 shall be conditioned at 25° \pm 2°C. (77° \pm 3.6°F.) and 50 \pm 4 percent relative humidity for 4 hours. The specimens shall be tested in accordance with ASTM D 903. The average shall be calculated and recorded as the sample value.

4.3.2.9 Corrosivity. Test panels of steel, aluminum, and brass conforming to QQ-S-698, grade FS 1018 or 1020, QQ-A-200/3 or QQ-A-225/6 and QQ-B-626 Copper Alloy Number 360 shall be buffed with fine emery cloth and washed free from dirt or oil with trichloroethylene. A few drops of the adhesive shall then be applied to each panel and allowed to stand for 24 hours at normal room temperature. The compound shall be removed by wiping with a cloth wet with the solvent and the sheets shall then be examined for etching. Anything more than a superficial discoloration shall be considered evidence of corrosivity.

4.3.2.10 Shelf storage life. A one-pint container, or an equivalent amount of smaller-size containers, of the adhesive shall be stored in the original unopened container or containers for one year from the date of manufacture at 75° \pm 5°F (24° \pm 3°C) and then shall be tested to determine compliance with the requirement of 3.11.

4.3.2.11 Toxicity. The supplier shall furnish the toxicological data and formulations required to evaluate the safety of the material for the proposed use.

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 Unit packaging. Unless otherwise specified, the adhesive shall be packaged in 1-pint, 1-quart, or 1-gallon metal cans complying with the requirements of PPP-C-96, type V, class 2, or in 5-gallon steel pails complying with the requirement of PPP-P-704, type II, class 3, with olive drab exterior coating, as applicable. Closure of 1-gallon containers shall be in accordance with the appendix to PPP-C-96.

5.1.2 Level B.

5.1.2.1 Unit packaging. The adhesive furnished in 3/4-ounce unit quantities shall be packaged in a glass bottle with a screw cap. The 1-pint, 1-quart, or 1-gallon quantities shall be packaged in a can conforming to PPP-C-961 type V, class 2, and the 5-gallon quantities shall be packaged in a pail conforming to PPP-P-704, type II, class 3 or 4.

MMM-A-189C

5.1.2.2 Intermediate packaging. Twenty-four 3/4-ounce unit containers of adhesive shall be intermediate packaged in a close-fitting box conforming to PPP-B-566, PPP-B-665, or PPP-B-676.

5.1.3 Level C. The adhesive shall be packaged in the quantities as specified (see 6.2) and in accordance with the manufacturer's commercial practice. However, protection shall be such as to prevent deterioration during shipment and prior to use.

5.2 Packing. Packing shall be level A, B, and C as specified (see 6.2).

5.2.1 Level A. The adhesive, packaged as specified in 5.1.1.1, shall be packed in accordance with the overseas shipment requirements given in the appendix to PPP-C-96. Unless otherwise specified, 5-gallon pails will require no overpacking.

5.2.2 Level B. The adhesive, packaged as specified in 5.1.2, shall be packed in accordance with the domestic shipment requirements given in the appendix to PPP-C-96. Unless otherwise specified, 5-gallon pails will require no overpacking.

5.2.3 Level C. The adhesive, packaged as specified in 5.1, shall be packed in a manner to insure carrier acceptance and safe delivery at destination. Containers shall be in accordance with Uniform Freight Classification or National Motor Freight Classification, as applicable.

5.3 Department of Transportation regulations. In addition to the requirements specified in 5.1 and 5.2, the adhesive shall be packaged and packed in accordance with the applicable requirements of the rules and regulations for the transportation of hazardous materials of the Department of Transportation for cement, rubber (see 6.4).

5.4 Marking.

5.4.1 Civil agencies. In addition to any special marking required by the contract or purchase order, unit and intermediate packages and exterior containers shall be marked in accordance with Fed. Std. No. 123 and with applicable requirements for cement, rubber, of the rules and regulations for the transportation of hazardous materials of the Department of Transportation. Each shipping container shall also be marked by months and year, not code, with the date of manufacture of the adhesive.

5.4.2 Military agencies. In addition to any special marking required by the contract or purchase order, unit and intermediate packages and exterior containers shall be marked in accordance with MIL-STD-129, and the applicable requirements for cement, rubber, of the rules and requirements for the transportation of hazardous materials of the Department of Transportation. Each shipping container shall also be marked by month and year, not code, with the date of manufacture of the adhesive.

5.4.3 Special marking. In addition to markings specified in 5.4.1 or 5.4.2 as applicable, information shall appear on each unit container and shipping container as follows:

- (a) Manufacturer's instructions for use (to include thinning directions if applicable).
- (b) Date of manufacture (by month and year, not by code)
- (c) Date of first reinspection (date one year from date of manufacture).
- (d) Flash point in degrees centigrade and degrees Fahrenheit.
- (e) Any special directions for storage or use of the adhesive.
- (f) In addition to the above the following instructions shall appear on each container:

DANGER! FLAMMABLE
KEEP AWAY FROM HEAT, SPARKS AND OPEN FLAME
STORE AT 60 to 80°F (16-27°C)

6. NOTES

6.1 Intended use. While the adhesive classes in this specification are intended for general-purpose applications, the user should satisfy himself with their suitability by preparing and testing specimens with the intended adherends, taking care that the surfaces of such adherends are properly prepared prior to bonding. Surface preparation methods are detailed in the technical literature and can often be obtained as recommendations by adhesive manufacturers for their particular formulation. The adhesives, being thermoplastic, are not recommended for applications where they will be subject to either continuous high stress, or stress at an elevated temperature. The class 2 adhesive (see 1.2) with its higher solids content forms heavier films with controlled penetration and is used for porous surfaces.

6.3 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) Class required (see 1.2).
- (c) Size of container required (see 5.1.1.1, 5.1.2.1 or 5.1.3) as specified.
- (d) Maximum shelf life recommended by manufacturer
- (e) Selection of applicable levels of packaging and packing (see 5.1 and 5.2).
- (f) Special marking if required (see 5.4.1 or 5.4.2 as applicable).
- (g) Whether the adhesive must be compatible with explosives or propellants (see 6.3).

6.3 Compatibility (reactivity and storage characteristics). For information and tests on the compatibility of adhesives (otherwise meeting the requirements of this specification) with explosives or propellants, contact Commander, Picatinny Arsenal, Dover, N.J. 07801, Attn. Chief, Materials Engineering Division (SARPA-FR-M), FRL. Testing can be carried out for a fee.

MMM-A-189C

6.4 Department of Transportation regulations. Tariff No. 19 is a reproduction, as of the date of this specification, of the Department of Transportation regulations covering the transportation of hazardous materials other than explosives and other dangerous articles.

6.5 Almost any commercially available pH meter will meet the requirements of 4.3.2.5.2. A typical bench instrument is Model 9608 supplied by Beckman Instruments, Inc. Most portable instruments are also acceptable (see 4.3.2.5.2).

MILITARY INTERESTS.

Custodians:

Army - MR
Air Force - 84

Preparing activity:

Army - MR

Civil Agency Coordinating Activity:

Review Activities:

GSA-FSS

Army - MD, ME, MI

User activities:

Navy - YD

(KBWP# ID-0267A/DISK 0108A. FOR AMMRC USE ONLY)

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.

(Fold along this line)

(Fold along this line)

DEPARTMENT OF THE ARMY



NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE \$300

BUSINESS REPLY MAIL
FIRST CLASS PERMIT NO 12062 WASHINGTON D C
POSTAGE WILL BE PAID BY THE DEPARTMENT OF THE ARMY

Director
US Army Materials & Mechanics Research Center
ATTN: DRXMR-SMS
Watertown, MA 02172



STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions - Reverse Side)

1 DOCUMENT NUMBER

MMMA-A-189C

2 DOCUMENT TITLE

3a NAME OF SUBMITTING ORGANIZATION

b ADDRESS (Street, City, State ZIP Code)

5 PROBLEM AREAS

a Paragraph Number and Wording

b Recommended Wording

c Reason/Rationale for Recommendation

REMARKS

4 TYPE OF ORGANIZATION (Mark one)

VENDOR

USER

MANUFACTURER

OTHER (Specify)

NAME OF SUBMITTER (Last First MI) - Optional

MAILING ADDRESS (Street, City, State ZIP Code) - Optional

b WORK TELEPHONE NUMBER (Include Area Code) - Optional

B DATE OF SUBMISSION (YYMMDD)