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SUPERSEDING
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MILITARY SPECIFICATION

ADHESIVES-SEALANTS, SILICONE, RTV, NONCORROSIVE (FOR USE WITH SENSITIVE METALS AND EQUIPMENT)

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

1. SCOPE

1.1 Scope. This specification covers three groups of one-part, room temperature-vulcanizing, non-fuel resistant, silicone compounds which cure to durable, rubber sealants and adhesives upon contact with moisture in the air. This specification also covers primers (see 6.1.3) for use with the silicone compounds.

1.1.1 Limitations.

a. Silicone adhesive-sealants covered by this specification are not fuel resistant.
b. Silicone adhesive sealants in each group liberate alcohol during cure.

1.2 Classification.

1.2.1 Groups of silicone adhesive-sealants. The silicone adhesive-sealants shall be classified into groups according to their intended use and outstanding property (see 6.1 and 6.2).

Group I - General purpose
Group II - High strength
Group III - High temperature

1.2.2 Types of silicone adhesive-sealants. Each group of silicone adhesive-sealants shall be subdivided into types as follows (see 6.1 and 6.2).

Type I - Thixotropic paste
Type II - Self-leveling liquid

1.2.3 Primer. The primer (if required) shall be as recommended by the manufacturer of the silicone-adhesive (see 6.1.3).

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Director, U.S. Army Laboratory Command, Materials Technology Laboratory, ATTN: SLCMT-MEE, Watertown, MA 02172-0001 by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC NO. A5033 FSC 8040

1.2.4 Military part number codes. The silicone adhesive-sealants shall be designated as follows (see 6.4):

Example: M46146 1 1 A B C

- C — Primer
- B — Color
- A — Container Size
- 1 — Type Identification
- 1 — Group Identification
- M46146 — Specification Identification

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATIONS

FEDERAL

J-C-30 - Cable and Wire, Electrical (Power, Fixed Installation)
QQ-A-250/4 - Aluminum Alloy 2024, Plate and Sheet
QQ-B-613 - Brass, Leaded and Nonleaded: Flat Products (Plate, Bar, Sheet, and Strip)
QQ-S-698 - Steel, Sheet and Strip, Low Carbon
PPP-B-566 - Boxes, Folding, Paperboard
PPP-B-601 - Box, Wood, Cleated-Plywood
PPP-B-636 - Box, Shipping Fiberboard
PPP-B-676 - Boxes, Set-up
PPP-C-96 - Cans, Metal, 28 Gage and Lighter
PPP-C-2020 - Chemicals, Liquid, Dry and Paste: Packaging of
PPP-D-705 - Drum: Shipping and Storage, Steel; 16 and 30 Gal Capacity
PPP-D-729 - Drums: Shipping and Storage, Steel, 55 Gallon (208 Liters)
PPP-P-704 - Pails, Metal: (Shipping, Steel 1 through 12 Gallon)
PPP-T-1637 - Tubes, Shipping, Collapsible

MILITARY

MIL-P-116 - Preservation, Methods of

STANDARDS

FEDERAL

FED-STD-313 - Material Safety Data Sheets, Preparation and Submission of

MILITARY

MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes
MIL-STD-129 - Marking for Shipment and Storage
MIL-STD-130 - Identification, Marking of U.S. property
MIL-STD-147 - Palletized Unit Loads

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Standardization Documents Order Desk, Bldg. 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

2.2 Non-Government publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the issue of the DODISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS are the issues of the documents cited in the solicitation (see 6.2).

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D149 - Dielectric Breakdown Voltage and Dielectric Strength of Electrical Insulating Materials at Commercial Power Frequencies
ASTM D150 - A-C Loss Characteristics and Dielectric Constant (Permittivity) of Solid Electrical Insulating Materials
ASTM D257 - D-C Resistance or Conductance of Insulating Materials
ASTM D412 - Rubber Properties in Tension
ASTM D573 - Rubber Deterioration in an Air Oven
ASTM D740 - Methyl Ethyl Ketone
ASTM D746 - Brittleness Temperature of Plastics and Elastomers by Impact
ASTM D903 - Peel or Stripping Strength of Adhesive Bonds
ASTM D1084 - Viscosity of Adhesives
ASTM D1153 - Methyl Isobutyl Ketone
ASTM D1298 - Density, Relative Density (Specific Gravity), or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method
ASTM D2240 - Rubber Property - Durometer Hardness

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

OFFICIAL CLASSIFICATION COMMITTEE

Uniform Freight Classification Rules.

(Application for copies should be addressed to the Uniform Classification Committee, 202 Union Station, 516 West Jackson Boulevard, Chicago, IL 60606).

NATIONAL MOTOR FREIGHT TRAFFIC ASSOCIATION, INC.

National Motor Freight Classification

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

(Non-Government standards and other publications are normally available from the organizations that prepare or distribute the documents. These documents also may be available in or through libraries or other informational services.)

2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 First article. When specified (see 6.2), a sample of adhesive-sealant and primer (when required,) furnished under this specification shall be subjected to the first article examination and all tests of this specification as specified in 4.5.3. Two representative containers of the silicone adhesive-sealant and two representative containers of the primer (if required) shall be selected for the tests. Approval of the first article inspection samples by the procuring activity shall not relieve the contractor of his obligation to supply silicone adhesive-sealant and primer that shall conform to the requirements of this specification. Any change or deviation from the complete inspection responsibility for the performance of the first article inspection shall be as specified by the procuring activity (see 6.2).

3.2 Material.

3.2.1 Silicone adhesive-sealant. The silicone adhesive-sealant shall be supplied in the group and type as specified (see 6.2) and shall vulcanize at room temperature to produce a rubbery adhesive-sealant to meet the physical and electrical properties of this specification (see 4.5.2.2).

3.2.2 Primer. The primer (if required) shall be an air drying liquid. When required, each manufacturer of adhesive-sealant shall supply a suitable primer which shall be furnished with the product. The manufacturer shall certify that the primer, when used with his adhesive meets the requirements for primer within this specification (see 3.4.2).

3.3 Product characteristics.

3.3.1 Uncured silicone adhesive-sealant. The uncured silicone adhesive-sealants shall be in accordance with the requirements of table I.

3.3.1.1 Corrosion. The silicone adhesive-sealant (and primer if required) shall not cause discoloration or corrosion when tested as follows:

a. Corrosion of brass, steel and aluminum over water (see 4.5.3.2.6.1).

b. Corrosion of copper wire by direct contact (see 4.5.3.2.6.2).

c. Corrosion of steel and aluminum by direct contact (see 4.5.3.2.6.3).

TABLE I. Physical properties of uncured silicone adhesive-sealant.

Property	Requirements			Test paragrapn
	Group I		Group II & III	
	Type I	Type II		
Total solids content, (%) min	92	92	92	4.5.3.2.1
Application rate (grams/min) min	100	-	40	4.5.3.2.2
Flow (inches) max	0.5	-	0.75	4.5.3.2.3
Viscosity (poises)	-	150-550	-	4.5.3.2.4
Tack free time (hours)	5.0	5.0	5.0	4.5.3.2.5

3.3.1.2 Storage life. The uncured silicone adhesive-sealants and primers (if required) shall meet all the requirements of this specification after 6 months of storage from date of shipment. Silicone adhesive-sealant that meets the requirements of extrusion rate or viscosity, as applicable, (3.3.1) tensile strength (3.3.2.1), elongation (3.3.2.1), and peel strength (3.3.2.1) may be considered to meet the storage life requirements when tested after storage as specified in 4.5.3.2.8.

3.3.2 Cured silicone adhesive-sealant.

3.3.2.1 Physical properties. The physical properties of the cured silicone compounds shall be as specified in table II.

3.3.2.1.1 Heat resistance. The cured silicone adhesive-sealant for Group I and Group II after exposure for 168 ± 4 hours (7 days ± 4 hours) at 392 ± 4°F (200 ± 2°C) shall meet the requirements for hardness, tensile strength and elongation as specified in table II when tested as specified in 4.5.3.1.2. Group III material after exposure for 72 ± 4 hrs (3 days ± 4 hrs) at 600 ± 4 °F (316 ± 2°C) shall have a hardness (Durometer) of 60 max, tensile strength of 200 psi, min (1379KPa) and elongation of 100% min.

3.3.2.1.2 Hydrolytic stability, physical. The cured silicone adhesive-sealant after exposure for 28 days ± 4 hours at 200 ± 4°F (93 ± 2°C) and 95 ± 2 percent relative humidity shall meet the requirements for hardness, tensile strength and elongation as specified in table II when tested as specified in 4.5.3.1.3, except that the tensile strength and elongation for group III material shall be 250 psi min., and 300 percent min., respectively.

3.3.2.2 Electrical properties. The electrical properties of the cured silicone adhesive-sealants shall be as specified in table III.

TABLE II. Properties of cured silicone adhesive-sealant.

Property	Requirements			Test Method
	Group I		Group II & III	
	Type I	Type II		
Brittle point	-80°F (-62°C)	-80°F (-62°C)	-80°F (-62°C)	ASTM D746 Procedure B
Hardness, Shore A Durometer, min	20	15	25	ASTM D2240
Tensile strength, psi (min) KPa (min)Pa (min)	(175) 1206	(150) 1034	(500) 3447	ASTM D412 (DIE C)
Elongation, percent (min)	300	150	500	ASTM D412 (DIE C)
Peel strength, lb				4.5.3.2.7
Aluminum lb/in, min Kg/max, min	15 0.3	4 0.1	40 0.7	4.5.3.2.7
Steel lb/in, min Kg/max, min	15 0.3	4 0.1	40 0.7	4.5.3.2.7

TABLE III. Electrical properties.

Property	Requirements Group I, II, III	Test Method
Volume resistivity at 73 ± 3°F, (23 ± 2°C) ohm/cm	1 x 10^{13} min	ASTM D257
Dielectric constant 100 to 100,000 Hertz	3.25 max	ASTM D150
Dissipation factor 100 to 100,000 Hertz	0.02 max	ASTM D150
Dielectric strength, Volts/mil at 77° ± 2°F (25 ± 1°C) 75 mil thickness	300 min	ASTM D149

3.4 Marking. A label shall be attached to each container of silicone adhesive-sealant and each container of primer with data as follows:

3.4.1 Adhesive sealant.

(a) Group and type of silicone adhesive-sealant, and type of primer as applicable.

(b) Brief instructions for the storage and care of silicone adhesive-sealant or primer (as applicable) prior to use.

(c) If required, a warning relative to toxicity (see 3.5).

(d) A warning as to fluid resistance (see 6.1.1).

(e) Instructions for use.

(f) Each label attached to the containers of silicone adhesive-sealant shall contain application instructions as follows:

Application. These one-component adhesive-sealants require moisture from the air to cure. When they are used the following are required:

(1) Good ventilation during cure.
(2) Full cure before enclosure (7 days minimum for thicknesses over 1/8 inch (3.2 mm), and 14 days minimum for thicknesses over 1/4 inch (6.4 mm)).
(3) Sufficient moisture to complete cure.
(4) Maximum thickness of 1/2 inch (12.7 mm).
(5) Maximum glueline of 1 inch (25.4 mm) when used between nonporous substrates.

3.4.2. Primer.

a) Manufacturer's primer identification
b) Instructions for storage and storage life
c) Instructions for use
d) Toxicity warning (if required)
e) NOTE: THIS PRIMER IS INTENDED FOR USE WITH MANUFACTURER'S DESIGNATED ADHESIVE-SEALANT ONLY

3.4.3 Additional marking. Each unit container of primer shall be marked as follows:

"CAUTION: APPLY ONLY IN A WELL VENTILATED AREA. KEEP AWAY FROM HEAT, SPARKS AND OPEN FLAME."

3.5 Toxicity. The silicone adhesive-sealant and primer shall have no adverse effect on the health of personnel. A material safety data sheet will be submitted in accordance with procedures outlined in FED-STD-313 (see 4.5.3.2.9, 4.5.3.2.10). Questions pertinent to this effect shall be referred by the contracting activity to the appropriate departmental medical service who will act as an advisor to the contracting agency.

3.6 Workmanship. The uncured silicone adhesive-sealant furnished under this specification shall be uniform in quality and consistency and shall be free of agglomerates or foreign particles. The cured adhesive-sealant shall present an appearance of smooth homogeneity. There shall be no other defect present which might render the end product unsuitable for its intended purpose. The primer shall be homogeneous and contain no foreign matter.

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 (examinations and tests) 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 this specification where such inspections are deemed necessary to ensure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items shall meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

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

a. First article tests (see 4.5.3.1)

b. Quality conformance inspection (see 4.5.3.2)

4.3 Sampling.

4.3.1 For examination. Unless otherwise specified a random sample of filled containers shall be selected for examination in accordance with level S-1 of MIL-STD-105.

4.3.2 Lot. A lot of silicone adhesive-sealant or primer shall consist of that quantity produced in one continuous operation from one batch of raw materials at one place of manufacture and offered for delivery at one time.

4.3.3 Sampling for tests. Two representative containers of each type of silicone adhesive-sealant and a representative container of primer shall be selected from each lot for all required tests (see 4.5.3).

TABLE IV. Classification of defects.

Item	Classification of defect	Defect	Method of inspection
	Critical	None defined	
Silicone adhesive-sealant (see 4.3.1, 3.2.1, and 3.6)	Major 101	Wrong group	Visual
	Major 102	Not uniform	Visual
	Major 103	Not free from agglomerates or foreign particles	Visual
	Major 104	Not homogeneous	Visual
Primer (see 4.3.1 3.2.2, and 3.6)	Major 105	Not homogeneous	Visual
	Major 106	Contains foreign matter 1/	Visual

1/ Some white precipitate with age is normal, and this should not be considered foreign matter.

4.4 Examination.

4.4.1 Silicone adhesive-sealant and primer (if required). Sample units selected in accordance with 4.3.1 shall be examined for defects shown in table IV.

4.5 Tests.

4.5.1 Preparation of specimens. Samples of uncured silicone adhesive-sealant selected as specified in 4.3.2 and conditioned as specified in 4.5.2.1 shall be used for the test. The equipment shall consist of a hydraulic or mechanical press and an open-face mold with a cavity 0.075 ± 0.010 inch (1.9 ± 0.3 mm) deep. The mold cavity shall be not less than 6 inches (152 mm) long by 4 inches (102 mm) wide. Specimens may be prepared by either Procedure A (4.5.1.1) or Procedure B (4.5.1.2).

4.5.1.1 Procedure A.

(a) Lay a piece of polyethylene coated paper that is larger than the face of the mold against the bottom of the mold.
(b) Apply a solution (Dupanol WAQ, (see 6.5)) diluted with 5 percent alcohol or equal is satisfactory) to the polyethylene coated paper to act as a release agent and allow to air dry for a minimum of 5 minutes. The mold release shall be of uniform thickness and free of entrapped air and imperfections.
(c) Place the chase frame on the mold.
(d) Fill the mold with the silicone adhesive-sealant and spread it to fill the chase (knife spread if Type I thixotropic paste). Molded sheet shall be of uniform thickness and free of entrapped air and surface irregularities.

(e) Type I. For type I (thixotropic paste) silicone adhesive-sealant, remove the chase when the sample has been spread into the chase and place the material on a rack that provides air exposure on both sides of silicone sheet, within 48 hours after preparation.

Type II. For Type II (self-leveling liquid) silicone adhesive-sealant keep the chase frame in position until the adhesive-sealant is cured, then remove the chase and place the paper with the material on a rack that provides air exposure on both sides of the silicone sheet within 48 hours after preparation.

4.5.1.2 Procedure B.

(a) Spray mold with Poly Lease 77 or an equivalent release agent.
(b) Prepare release paper by soaking a sheet of Ozalid reproduction paper (APECO Positive Paper No. 2, or equivalent) in distilled water for 1 to 5 minutes.
(c) Place wet release paper on upper face of mold with gelatin surface facing the silicone compound. Wipe excess water from the release paper.
(d) Fill the mold cavity with the silicone adhesive-sealant. Close the mold and press with approximately 50 psi (345 kPa) pressure.
(e) After 1 hour lift the upper face of the mold and carefully remove the paper from the sheet. Leave the sheet in the mold with the upper face exposed until the sheet is well cured. This usually requires 6 - 18 hours. Leave the sheet in the mold no longer than 24 hours.

4.5.2 Conditioning of specimens.

4.5.2.1 Uncured silicone adhesive-sealant. The uncured silicone adhesive-sealant before being tested shall be conditioned at 74 $\pm$ 4°F (23 $\pm$ 2°C) and 50 $\pm$ 5 percent relative humidity for not less than 48 hours.

4.5.2.2 Cured silicone adhesive-sealant. Before being tested for all requirements of this specification the silicone adhesive-sealant prepared as specified in 4.5.1 shall be cured at 74 $\pm$ 4°F (23 $\pm$ 2°C) and 50 $\pm$ 5 percent relative humidity for 168 $\pm$ 4 hours (7 days $\pm$ 4 hours).

4.5.3 Classification of tests. Tests for the silicone adhesive-sealant and primer shall be as follows:

(a) First Article Tests (see 4.5.3.1)
(b) Quality Conformance Inspection (see 4.5.3.2)

4.5.3.1 First article tests. First article tests shall be conducted on the first article sample (see 3.1) and also at the discretion of the procuring activity (6.2). The first article test shall consist of all tests of this specification, and the additional tests as indicated in table V and VI. If a lot should fail a first article test, no further lot will be accepted until the supplier has presented sufficient evidence to show that the condition which caused the failure has been corrected.

TABLE V. Additional tests for complete inspection.

Characteristic	Requirement	Test Method
Corrosion	3.3.1.1 (b)	4.5.3.2.6.2
	3.3.1.1 (c)	4.5.3.2.6.3
Brittle point	3.3.2.1	ASTM D746
Resistance to heat	3.3.2.1.1	ASTM D573
Hydrolytic stability, physical	3.3.2.1.2	4.5.3.1.3
Volume resistivity	3.3.2.2	ASTM D257
Dielectric constant	3.3.2.2	ASTM D150
Dissipation factor	3.3.2.2	ASTM D150
Storage life (uncured compound)	3.3.1.2	4.5.3.2.8

4.5.3.1.1 Brittle point. Samples of uncured silicone adhesive-sealant shall be prepared as specified in 4.5.1 and cured as specified in 4.5.2.2. Modified T-50 specimens shall be die punched from the pads. Tests shall be in accordance with Procedure B of ASTM Method D746.

4.5.3.1.2 Resistance to heat. Specimens of the silicone adhesive-sealant prepared as specified in 4.5.1 and cured as specified in 4.5.2.2 shall be oven aged as specified in ASTM D573 for the duration and temperature as specified in 3.3.2.1.1. At the end of the exposure time the test specimens shall be brought to and tested at room temperature 74 ± 4°F (23 ± 2°C) and 50 ± 5 percent relative humidity for compliance with the requirements of 3.3.2.1.1.

4.5.3.1.3 Hydrolytic stability, physical. Specimens of the silicone adhesive-sealant prepared as specified in 4.5.1 and cured as specified in 4.5.2.2 shall be placed vertically in a suitable holder on a tray in a suitable glass desiccator. The bottom of the desiccator shall contain a glycerine (22 percent by weight) in water solution which will produce a relative humidity (RH) of 95 percent at the test temperature. The desiccator containing the specimens shall be closed and then placed in an air circulating oven maintained at 200 ± 4°F (93 ± 2°C) for a period of 28 days ± 4 hours. At the end of the exposure period the desiccator shall be removed from the oven and cooled to 74 ± 4°F (23 ± 2°C) for 16 to 24 hours. The specimens shall then be removed from the desiccator and tested for hardness, tensile strength and elongation as specified in 3.3.2.1.2.

4.5.3.2 Quality conformance inspection. Quality conformation inspection shall be made on each lot of silicone adhesive-sealant and primer (if required) and together with the examination (see 4.4.1 and 4.6.1.3) shall be the basis for acceptance or rejection of the lot. Quality conformance inspection shall consist of the tests indicated in table VI.

4.5.3.2.1 Total solids (silicone adhesive-sealant). Three specimens shall be tested and results averaged. Each specimen shall be tested as follows: Transfer 5 to 10 grams of the uncured silicone adhesive-sealant as rapidly as possible to a cup approximately 3 inches (76 mm) in diameter and 3/4 inch (19 mm) in depth. Place a fitted cover immediately over the cup to determine the weight. (The weight of the cup and the cover shall be determined accurately prior to using, and subtracted from the initial and final weights in order to calculate the net sample weights.) Then remove the

cover and heat the sealing adhesive-sealant for 24 ± 1 hour at 156 ± 3°F (70 ± 2°C). Cool the sealing compound and cup. Evaporate in a desiccator, replace the cover and weigh accurately. Calculate the percent of total solids as follows

$$\text{Percent of solids} = \frac{\text{Final weight X 100}}{\text{Initial weight}}$$

4.5.3.2.2 Application rate (group I and III sealant only). The uncured silicone adhesive-sealant and application gun shall be stabilized at 77 ± 4°F (25 ± 2°C) and 50 ± 5 percent relative humidity for at least 8 hours. A minimum of 250 grams of the adhesive-sealant shall be promptly used to fill a standard Semco or equal sealing-compound-gun cartridge having a Semco 440 nozzle or equivalent, with an orifice diameter of 1/8 inch (3 mm). The gun and sealing adhesive-sealant shall be maintained at the above conditions throughout the test. The gun shall be attached to a constant air supply of 90 ± 5 psi (620 ± 10 kPa) for line variation or gage error. From 2-3 inches (50-75 mm) of sealing adhesive-sealant shall be extruded initially to clear trapped air. The sealing adhesive-sealant shall be extruded onto a suitable receptacle for 1 minute and the amount of extruded sealing adhesive-sealant determined. Calculate the application rate in grams per minute.

TABLE VI. Quality conformance inspection.

Test Characteristic	Requirements			Test Method
	Group I	Group II	Group III	
Uncured compound				
Total solids content	3.3.1	3.3.1	3.3.1	4.5.3.2.1
Application rate	3.3.1	---	3.3.1	4.5.3.2.2
Flow	3.3.1	---	3.3.1	4.5.3.2.3
Viscosity	---	3.3.1	---	ASTM D1084 Method B
Tack free time	3.3.1	3.3.1	3.3.1	4.5.3.2.5
Corrosion 1/	3.3.1.1 (a)	3.3.1.1 (a)	3.3.1.1 (a)	4.5.3.2.6.1
Cured compound		Groups I - III		
Hardness		3.3.2.1		ASTM D2240
Tensile strength		3.3.2.1		ASTM D412 (Die C)
Elongation		3.3.2.1		ASTM D412 (Die C)
Peel strength		3.3.2.1		4.5.3.2.7
Dielectric strength		3.3.2.2		ASTM D149

1/ When authorized by the procuring activity shipment may be made prior to the completion of the corrosion test upon receipt of a letter (see 4.5.3.2.9) certifying that the sealing adhesive-sealant shall meet the corrosion test requirements of 3.3.1.1 a.

4.5.3.2.3 Flow (group I and III sealant only). The flow test shall be conducted with a flow test jig as shown in figure 1. The uncured silicone adhesive-sealant and the jig shall be stabilized at 74° ± 4°F (23 ± 2°C) and 50 ± 5 percent relative humidity for at least 6 hours. Depth of plunger tolerance is critical and shall be controlled within the tolerance during all tests. The flow test jig shall be placed on a table with the front face upward and with the plunger depressed to the limit of its travel. Enough of the silicone adhesive-sealant to fill the recessed cavity of the jig shall be rapidly transferred from a representative sample container. The adhesive-sealant shall not be worked with a spatula but shall be leveled off even with block by scraping with a spatula in two passes, each starting in the center and moving toward the sides of the jig. Within 10 seconds after the leveling operation, the jig shall be placed on its base and the plunger immediately advanced to the limit of its forward travel. The cylindrical section formed in the flow-test jig shall be allowed to flow under its own weight on a vertical surface. The flow test shall begin when the plunger is advanced to the limit of its forward travel, and flow measurements shall be measured from tangent to the lower edge of the plunger to the farthest point to which flow has occurred. The measurement after the indicated interval shall be considered the initial flow of the silicone adhesive-sealant.

4.5.3.2.4 Viscosity (group II adhesive-sealant only). The viscosity of the silicone adhesive-sealant shall be determined in accordance with ASTM D1084, Method B. The uncured silicone adhesive-sealant and viscosimeter shall be stabilized at 74 ± 4°F (23 ± 2°C) and 50 ± 5 percent relative humidity for 6 hours. The viscosimeter model, spindle number and speed shall be reported as part of the viscosity determination.

4.5.3.2.5 Tack-free time. At the end of the rated tack-free time of the uncured silicone adhesive-sealant a 1-inch by 6-inch (25 mm by 152 mm) polyethylene film measuring 0.004 ± 0.002 inch (0.10 ± 0.05 mm) thick shall be applied and held in place at a pressure of 1/2 ounce per square inch (0.22 kPa) for two minutes on each of several sealing adhesive-sealant specimens. The film shall then be slowly withdrawn at right angles to the surface of the sealing adhesive-sealant. The polyethylene shall come away clean and free of sealing adhesive-sealant.

4.5.3.2.6 Corrosion.

4.5.3.2.6.1 Corrosion of brass, steel and aluminum over water. Two panels 4 inches by 1 inch (102 mm by 25 mm) shall be prepared for each of the following metals: Copper alloy conforming to number or composition 230 of QQ-B-613, steel conforming to QQ-S-698 and aluminum conforming to QQ-A-250/4. The panels shall be cleaned with steel wool (or number 400 emery cloth if required) rinsed with acetone and blotted dry with a lint-free cloth. For each of the three metals make the following tests:

Extrude 15 grams of silicone adhesive-sealant into an 8-ounce (240 ml)glass bottle equipped with a PTFE lined cap. Pour 5 to 10 ml of distilled water over the silicone adhesive-sealant and hang one cleaned panel above the adhesive-sealant-and-water mix. Then close the top of the bottle. Pour into a control bottle of the same type 5 to 10 ml distilled water; hang the other metal panel above the water then close the top of the bottle. Maintain both the test bottle and the control bottle at 100 ± 4°F (38 ± 2°C) for 168 ± 4

hours (7 days ± 4 hours). At the end of this period carefully remove the panels from the bottles. Visually inspect the test panel for corrosion or discoloration by comparison with the control panel for compliance with the requirements of 3.3.1.1a.

4.5.3.2.6.2 Corrosion of copper wire by direct contact. Prepare three 1 1/2 inches (38 mm) lengths of AWG size copper wire conforming to J-C-30 by first removing all insulation and then cleaning with a suitable degreasing agent. Encapsulate 2 wire specimens one primed (if primer is required) and one unprimed centrally into a suitable mold 1 inch by 2 inch by 1/4 inch (25 mm by 51 mm by 6 mm). Cure the adhesive-sealant at 74 ± 4°F (23 ± 2°C) and 50 ± 5 percent relative humidity for 168 ± 4 hours (7 days ± 4 hours). Place the specimens along with the unpotted 1-1/2 inches (38mm) length of the above specified wire into an environment of 95 to 98 percent relative humidity and 120 ± 2°F (49 ± 1°C) for 28 days. At end of the period split open the mold and compare the wires that had been encapsulated with the control wire for compliance with the requirements of 3.3.1.1b.

4.5.3.2.6.3 Corrosion of steel and aluminum by direct contact. Panels approximately 4 inches by 1 inch (102 mm by 25 mm) of steel and aluminum conforming to QQ-S-698 and QQ-A-250/4, respectively, shall be cleaned with steel wool or number 400 emery cloth, rinsed with acetone and blotted dry. Coat approxmiately 1/3 of the surface of each panel with the primer, if required, (see 6.2). Recoat the primed surface and an additional 1/3 of the total surface with the sealing adhesive-sealant to a thickness of approximately 1/16 inch (1.6 mm). Cure the sealing adhesive-sealant at 77 ± 2°F (25 ± 1°C) and 50 ± 5 percent relative humidity for 168 hours ± 4 hours (7 days ± 4 hours). Place the panels into an environment of 95 to 98 percent relative humidity and 120 ± 2°F (49 ± 1°C) for 28 days. At the end of this period remove the sealing adhesive-sealant by peeling and compare the surfaces that had been coated with the uncoated surfaces for compliance with the requirements of 3.3.1.1c.

4.5.3.2.7 Peel strength. Test for peel strength shall be as specified in ASTM Method D903. Laboratory conditions shall be 74 ± 4°F (23 ± 2°C) and 50 ± 5 percent relative humidity. Panels shall be of aluminum alloy conforming to QQ-A-250/4; and of cold rolled No. 1 finish (dull) sheet steel conforming to QQ-S-698. Clean, prime (if required) and air dry the panels in accordance with directions from the manufacturer. Clean steel strip with steel wool and an abrasive cleaner, (scouring powder). Rinse and dry the strip. Clean the panel and the strip with methylisobutylketone (MIBK) or methylethylketone (MEK) and cotton gauze, (cheesecloth). Rub vigorously to insure both get clean. Clean the panel and the ship with acetone using clean cheesecloth. Dry the panel and strip with clean cheesecloth. Allow the panel and the strip to air dry at lab conditions for a half hour minimum after cleaning. Prim both substrates as required. VERY IMPORTANT: RUB THE PRIMER IN VIGOROUSLY. DO NOT POUR EXCESS PRIMER ON THE SUBSTRATES. Allow the primer to dry for 2 hours minimum. Examine the primer (if required) for compliance with 3.2.2. Coat each panel with approximately 1/16 inch (1.6 mm) of silicone adhesive-sealant. Place primed (if primer is required) 30-mesh, 10-mil wire aluminum screens or cold rolled steel strip number SAE 1008 or SAE 1010 (1/4" x 0.010" x 12") (6.3 mm x 0.25 mm x 304 mm) on the silicone adhesive-sealant immediately. If the screen method is used, apply a second coat 1/16 inch (1.6 mm) thick. Cure as specified in 4.5.2.2. Test the peel strength in

accordance with ASTM D903, except that the rate of separation shall be 2 inches (50 mm) per minute.

4.5.3.2.8 Storage life. Unless otherwise specified (see 4.5.3.2.9) two samples of the uncured silicone adhesive-sealant and a sample of the primer (if required) in accordance with first article tests (see 4.5.3.1) from each lot shall be stored in their original containers for 6 months at a temperature of 77 ± 4°F (25 ± 2°C) and a relative humidity of 50 ± 5 percent. When authorized by the procuring activity the supplier may certify in lieu of a test (see 4.5.3.2.9) that the sealing adhesive-sealant and primers (if required) shall meet the storage life requirements specified in 3.3.1.2.

4.5.3.2.9 Material safety data sheets. A Material Safety Data Sheet and other appropriate documentation shall be supplied for each shipment as required by law. This information shall be signed by a responsible agent of the organization authorized to submit this material information. The Government reserves the right to check test material submitted by the supplier.

4.5.3.2.10 Toxicity. The contractor shall have the toxicological product formulations and associated information available for review by the contracting activity to evaluate the safety of the silicone adhesive-sealant and primer (if required) for the proposed use (see 3.5, 6.6).

4.5.4 Rejection criteria. Failure of any test specimen or sample to meet the test requirements specified herein shall be cause for rejection of the lot represented.

4.6 Inspection of packaging. Except when commercial packaging is specified, the sampling and inspection of the preservation and interior package marking shall be in accordance with groups A and B quality conformance inspection requirements of MIL-P-116. The sampling and inspection of the packing for shipment and storage shall be in accordance with the quality assurance provisions of the applicable container specification shown in section 5. The inspection of marking for shipment and storage shall be in accordance with MIL-STD-129.

4.6.1 Quality conformance inspection of pack.

4.6.1.1 Unit of product. For the purpose of inspection, a completely processed pack prepared for shipment shall be considered a unit of product.

4.6.1.2 Sampling. Sampling for examination shall be in accordance with MIL-STD-105.

4.6.1.3 Examination. Samples selected in accordance with 4.6.1.2 shall be examined for the defects indicated in table VII. The presence of one or more defects shall be cause for rejection.

5. PACKAGING

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

5.1.1 Level A.

5.1.1.1 Silicone adhesive-sealant. The silicone adhesive-sealant shall be placed in tubes, cartridges, pails or drums as specified (see 6.2). The tubes shall conform to requirements of PPP-T-1637, type and class as specified (see 6.2), and the filled tubes shall be packaged in accordance with the Appendix to PPP-T-1637. The dispensing gun cartridge shall be aluminum foil wrapped. Pails shall be 5-gallon (19 liter) capacity and shall conform to PPP-P-704, Type 1, Class 2. The drums shall be 30-gallon (113 liters) capacity conforming to PPP-D-705 or 55-gallon (208 liter) capacity conforming to PPP-D-729. Pails and drums shall have sufficient outage to prevent leakage of contents or distortion of containers as a result of expansion of contents during transit or storage.

5.1.1.1.1 Intermediate packaging. Tubes and dispensing gun cartridges of the same size shall be packaged in snug-fitting boxes conforming to the water resistant variety of either PPP-B-566 or PPP-B-676 at the option of the contractor. Quantities and arrangements shall be in accordance with commercial practice. Box closures shall be as specified in the box specifications.

5.1.1.2 Primer. The primer (when required) shall be placed in either cans or bottles of the size specified (see 6.2). The cans shall conform to PPP-C-96 Type V, Class 4 and the cans shall be packaged in accordance with the level A requirements of the Appendix to PPP-C-96. Bottles and their packaging shall be in accordance with level A requirements of PPP-C-2020.

5.1.2 Level C.

5.1.2.1 Silicone adhesive-sealant and primer. The silicone adhesive-sealant and primer (if required) in the size containers and quantities specified (see 6.2) shall be packaged to provide adequate protection against deterioration and damage from the supplier to the initial destination. The suppliers commercial practice may be used when it meets these requirements.

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

5.2.1 Level A.

5.2.1.1 Silicone adhesive-sealant. Silicone adhesive-sealant tubes or cartridges preserved as specified (see 5.2) shall be packed in boxes conforming to PPP-B-601, over- seas type, Style I in quantities as specified (see 6.2). Pails and drums will not require any additional packing.

5.2.1.2 Primer. Primer (when required) preserved in cans as specified in 5.2 shall be packed in accordance with level A requirements of the Appendix to PPP-C-96 except that the exterior shipping containers shall conform to the requirements of PPP-B-601 overseas type, Style I in quantities as specified (see 6.2). Primer preserved in bottles as specified in 5.2 shall be packed in accordance with the level A requirements of PPP-C-2020.

5.2.1.3 Palletization. When specified (see 6.2) 5-gallon (19 liter) pails or other exterior containers of the silicone adhesive-sealant and primer shall be palletized in accordance with requirements of MIL-STD-147.

TABLE VII. Classification of defect, packaging requirements.

Item	Classification of defect	Defect	Method of Inspection
	CRITICAL	NONE DEFINED	
Unit containers of silicone adhesive-sealant and primer (see 5.1)	Major 107	Improper type	Visual
	Major 108	Improper size	Visual
	Major 109	Improper fill 1/	Approved scale
	Major 110	Leakage	Visual
	Major 111	Improper closure	Visual
Intermediate packaging 3/ (see 5.2.1.1.1)	Major 112	Wrong type	Visual
	Major 113	Improper size	Visual
	Major 114	Improperly closed	Visual
Box open (see 5.3)	Major 115	Wrong type	Visual
	Major 116	Improper size	Visual
	Major 117	Wrong quantity	Visual
	Major 118	Pads or separators missing 3/	Visual
Box closed	Major 119	Lack of or improper strapping	Visual
	Major 120	Improperly closed	Visual
	Major 121	Gross, weight, max.	Approved scale 2/
	Major 122	Pallets missing or improper 3/	Visual
	Major 123	Improper marking	Visual

1/The actual weight of a container filled with the minimum required quantity of silicone adhesive-sealant or primer shall be the basis for determining the acceptable weight of subsequent containers.

2/Approved by procuring activity.

3/When applicable.

5.2.2 Level B.

5.2.2.1 Silicone adhesive-sealant. Silicone adhesive-sealant in tubes or cartridges and preserved as specified (see 5.2) shall be packed in fiberboard boxes conforming to PPP-B-636 style W5c. Fiberboard boxes shall not exceed the weight limitation of the box specification. Pails and drums will require no over-packing.

5.2.2.2 Primer. Primer (when required) preserved in cans or bottles as specified in 5.2 shall be packed in accordance with level A requirements of the Appendix to PPP-C-96 (for cans) or in accordance with level A requirements of PPP-C-2020 (for bottles) as applicable.

5.2.2.3 Palletization. When specified (see 6.2) 5-gallon (19 liter) pails or other exterior containers of the silicone adhesive-sealant and primer shall be palletized as specified in 5.3.1.3.

5.2.3 Level C. Silicone adhesive-sealant and primer shall be packed to assure carrier acceptance and safe delivery to destination at lowest rates in compliance with Uniform Freight Classification Rules and National Motor Freight Classification.

5.3 Marking. In addition to any special marking required by the contract or order herein, interior and exterior shipping containers shall be marked in accordance with MIL-STD-129 for military levels of protection. A label shall be attached to each exterior container of silicone adhesive-sealant and primer (if required) with additional data as follows:

(a) Number and title of this specification.
(b) Adhesive-sealant group type.
(c) Expiration date of shelf life.
(d) Brief instructions for the storage and care of the silicone adhesive-sealant or primer as applicable prior to use.
(e) Cure time if other than that specified (see 4.5.2.2).
(f) WARNING: relative to toxicity (see 3.5).
(g) WARNING: as to fluid resistance (see 6.1.1)
(h) Label attached to containers of silicone adhesive-sealant shall contain application instructions (see 3.4)
(i) Mark for identification to include military part number (see 6.4).
(j) Each unit container of primer shall be marked as follows: "CAUTION: APPLY ONLY IN A WELL VENTILATED AREA. KEEP AWAY FROM HEAT, SPARKS, AND OPEN FLAME"

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. Since the silicone adhesive-sealants are available as thixotropic pastes, or as self-leveling liquids, they lend themselves to a variety of application techniques which are easily adapted to speciality uses as well as to production line methods. As these materials are non-corrosive to copper and other sensitive metals they are gaining wide acceptance as preferred adhesives and sealants where delicate electronic devices are involved.

They are used in sealing instrument cases, as environmental seals for sealing electronic devices, as terminal sealants, for potting electronic components and as high temperature sealants.

6.1.1 WARNING. These silicone adhesive-sealants are not resistant to many types of fluids such as fuel and hydraulic fluids.

6.1.2 Thickness and glue lines. With these one-component adhesive sealants which require moisture from the air to cure, the thicknesses should be limited to 1/2 inch (13 mm), and the glue lines limited to 1 inch (25 mm) between nonporous substrates.

6.1.3 Primer. The use of a primer is recommended for various substrates to achieve consistent results and obtain optimum adhesion when the silicone adhesive-sealant is exposed to water, high humidity and elevated temperature conditions. A primer should be used only as directed by the manufacturer and should be used only with the adhesive-sealant for which the primer was supplied. The use of silicone adhesive-sealant and primer combinations other than those recommended by the manufacturer may lead to loss of adhesion or bond failure.

6.2 Ordering data.

6.2.1 Acquisition requirements. Acquisition documents should specify the following:

(a) Title, number and date of this specification.
(b) Group and type of silicone (see 1.2.1 and 1.2.2) adhesive-sealant required.
(c) Quantity of silicone adhesive-sealant required.
(d) Quantity of primer (if required) (see 6.1.3).
(e) Whether the silicone adhesive-sealant is to be preserved in tubes, cartridges, pails, or drums (see 5.2.1.1).
(f) Container size for silicone adhesive-sealant and primer (see 5.2).
(g) Levels of preservation and packing required (see 5.1, 5.2).
(h) Palletization required (see 5.2.1.3, 5.2.2.3).
(i) Responsibility for the performance of first article inspection (see 4.5.3.1).
(j) Responsibility for quality conformance inspection (see 4.5.3.2)

6.2.2 Consideration of data requirements. The following data requirements should be considered when this specification is applied on a contract. The applicable Data Item Descriptions (DID's) should be reviewed in conjunction with the specific acquisition to ensure that only essential data are requested/provided and that the DID's are tailored to reflect the requirements of the specific acquisition. To ensure correct contractual application of the data requirements, a Contract Data Requirements List (DD Form 1423) must be prepared to obtain the data, except where DOD FAR Supplement 27.475-1 exempts the requirement for a DD Form 1423.

Reference Paragraph	DID Number	DID Title	Suggested Tailoring
4.5.3.2.9	DI-MISC-80678	Certificate of Completion	---

The above DID was that cleared as of the date of this specification. The current issue of DOD 5010.12-L, Acquisition Management Systems and Data Requirements Control List AMSDL), must be researched to ensure that only current, cleared DID's are cited on the DD Form 1423.

(Copies of data item descriptions related to this specification, and identified in section 6 will be approved and listed as such in DOD 5010.12L, Vol. II, AMSDL. Copies of data item descriptions required by the contractors in connection with specific acquisition functions should be obtained from the Standardization Documents Order Desk, Bldg. 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094 or as directed by the contracting officer.)

6.2.2.1 First article data. When First Article samples are submitted (see 6.2), they should be accompanied by a complete inspection report showing the results of the Contractor's inspections. The inspection report shall include the following:

(a) Report of inspection graphically presented when possible, together with a detailed statement indicating compliance or extent of noncompliance with all requirements of this specification, referring specifically to paragraph numbers. Wherever a requirement is considered to be not applicable, the report shall so state.

(b) Diagrams of inspection set-ups. A complete description of inspection equipment and inspection procedures.

(c) Reproducible outline and description conditions. Where inspections specified in this specification are not considered applicable, the reason, and the substituted inspection should be clearly described.

(d) Copies of inspection log sheets.

(e) Photographs when available.

6.3 First article. When a first article inspection is required, the item will be tested and should be a first article sample. The first article sample should consist of two representative containers of the silicone adhesive-sealant and two representative containers of the primer (if required). The contracting officer should include specific instructions in acquisition documents regarding arrangements for examinations, tests and approval of the documents first article.

6.4 Military part number coding. Table VIII describes the military part number coding for one component silicone RTV's that correspond to the types covered by this specification.

6.5 Trade name. Dupanol WAQ is manufactured by E.I. Dupont de Nemours & Co., Inc., Wilmington, Delaware 19807.

6.6 Toxicity. Questions pertinent to the effect of the silicone adhesive-sealant and primer on the health of personnel will be referred by the procuring activity to the appropriate department medical service who will act as an advisor to the procuring activity.

6.7 Color of silicone compound. Each manufacturer has his own colors for silicone compounds. These colors, not all made by one manufacturer, include white, red, black, translucent, gray, and special colors.

6.8 Key words.

Silicone RTV
One-component
Adhesive-sealant

Custodians
Army - MR
Navy - AS
Air Force - 11

Preparing activity:
Army - MR

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Review activities:
Army - AR, ME, MD, AT, MI, SM
Navy - AS, EC, YD
Air Force - 11, 99

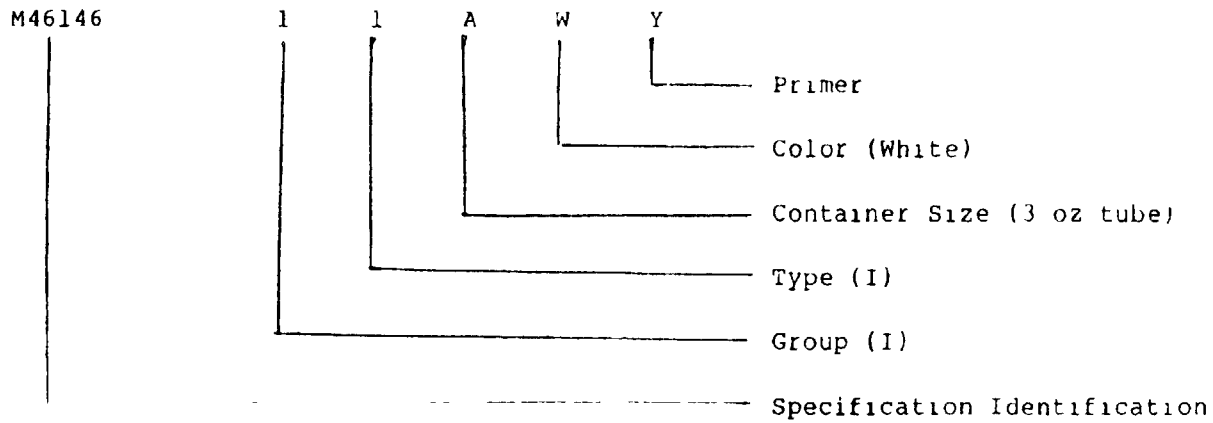
User activities:
Army - CE, MI, AL,
Navy - OS, SH, YD
Air Force - 17
GSA-FSS (10 FTE)
DLA - GS

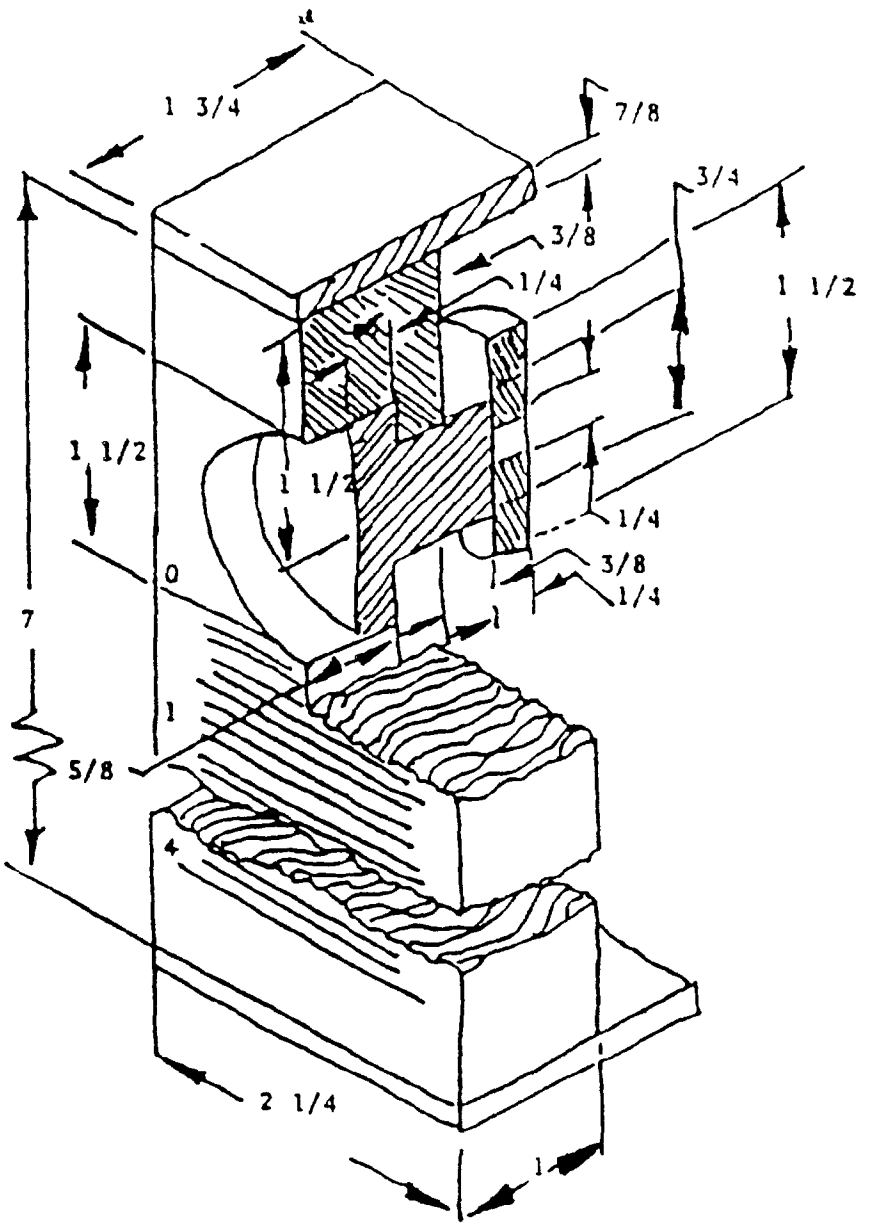
(WP# ID-0815A/0007A. FOR MTL USE ONLY)

TABLE VIII. Military part number coding.

Group	Code	Type	Code	Container Size	Code	Color	Code	Primer Required	Code
I	1	I	1	3 oz tube	A	White	W	Yes	Y
II	2	II	2	12 oz cartridge	B	Translucent	T	No	N
III	3			pint	C				
				5 gallon pail	D				
				50 gallon drum	E				

Example:





Material: Aluminum Alloy
Dimensions in inches. Unless otherwise specified, tolerances: ± 0.003 in.

FIGURE 1. Flow test jig.