NOT MEASUREMENT SENSITIVE

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SUPERSEDING
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DETAIL SPECIFICATION

ADHESIVES-SEALANTS, SILICONE, ROOM TEMPERATURE VULCANIZING (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, non-fuel resistant, RTV 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 are 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.

Comments, suggestions, or questions on this document should be addressed to: Director, U.S. Army DEVCOM, Army Research Laboratory, Army Research Directorate, Specifications and Standards Office, Attn: FCDD-RLA-M, Aberdeen Proving Ground, MD 21005-5069. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at https://assist.dla.mil/.

AMSC N/A FSC 8040

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

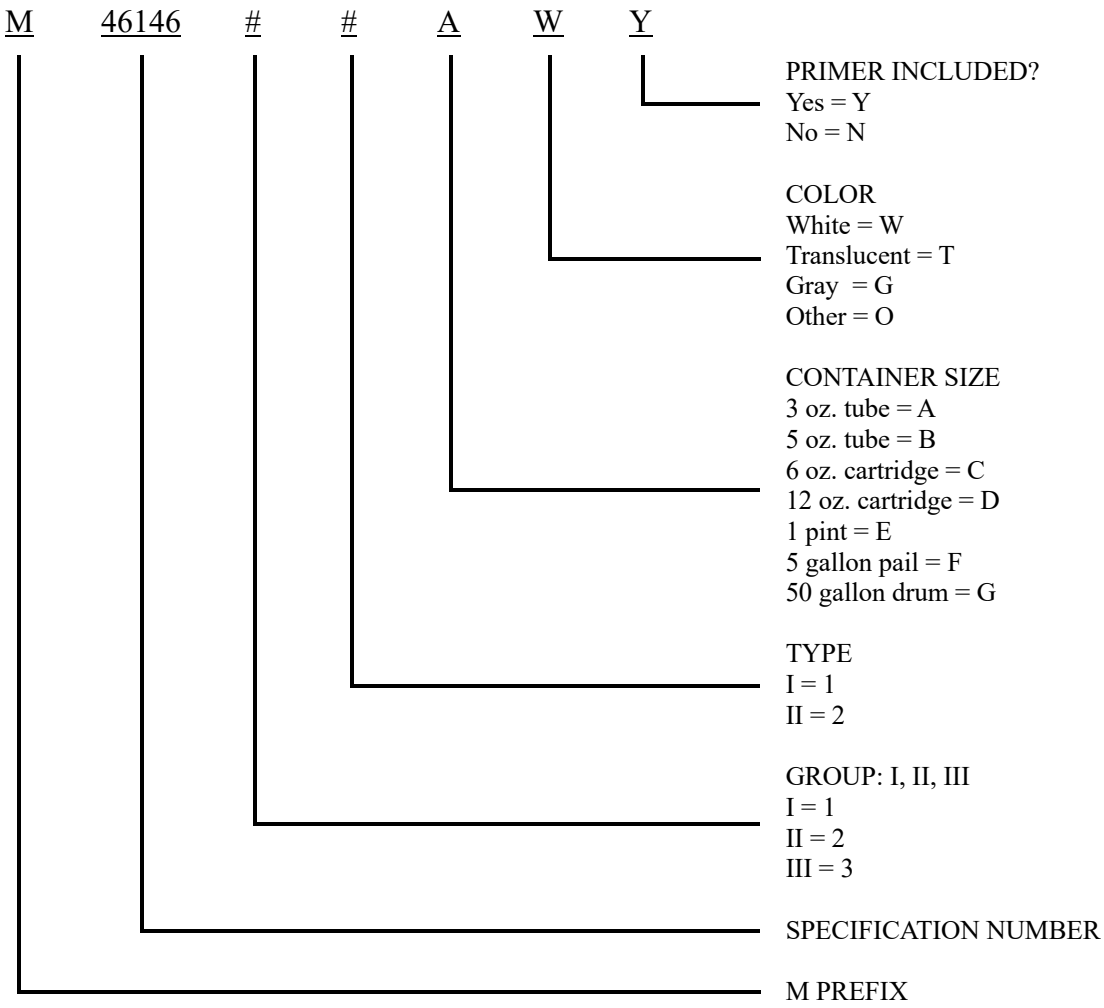
1.2.2 Types of silicone adhesive-sealants. Each group of silicone adhesive-sealants are subdivided into types as follows (see 6.1 and 6.2).

Type I - Thixotropic paste.

Type II - Self-leveling liquid

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

1.3 Part or Identifying Number (PIN). Use the following example to create the PINs to be used for silicone adhesive-sealants acquired to this specification:



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 cited in the contract or purchase order.

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-129	-	Marking for Shipment and Storage
MIL-STD-1916	-	DoD Preferred Methods for Acceptance of Product

(Copies of these documents are available online at https://quicksearch.dla.mil/.)

2.2. Other Government documents, drawings, and publications. The following other Government documents, drawings, and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

COMMERCIAL ITEM DESCRIPTIONS

A-A-59544	-	Cable and Wire, Electrical (Power, Fixed Installation)

FEDERAL STANDARDS

FED-STD-123	-	Marking for Shipment (Civil Agencies)
FED-STD-313	-	Material Safety Data, Transportation Data, and Disposal Data for Hazardous Materials Furnished to Government Activities.

(Copies of these documents are available online at https://quicksearch.dla.mil/).

DEPARTMENT OF TRANSPORTATION (DOT)

49 CFR 100-199	-	Rules and Regulations for the Transportation of Hazardous Materials

(Copies of this document are available online at https://www.ecfr.gov/current/title-49).

2.3 Non-Government publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the contract or purchase order.

THE AMERICAN NATIONAL STANDARDS INSTITUTE

ANSI/ASQ Z1.4	-	Sampling Procedures and Tables for Inspection by Attributes

(Copies of this document are available online at https://ansi.org/).

ASTM INTERNATIONAL

ASTM A794/A794M	-	Standard Specification for Commercial Steel (CS), Sheet, Carbon (0.16 % Maximum to 0.25 % Maximum), Cold-Rolled

ASTM B16	-	Standard Specification for Free-Cutting Brass Rod, Bar and Shapes for Use in Screw Machines
ASTM B209/B209M	-	Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM D149	-	Standard Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies
ASTM D150	-	Standard Test Methods for AC Loss Characteristics and Permittivity (Dielectric Constant) of Solid Electrical Insulation
ASTM D257	-	Standard Test Methods for DC Resistance or Conductance of Insulating Materials
ASTM D412	-	Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension
ASTM D573	-	Standard Test Method for Rubber - Deterioration in an Air Oven
ASTM D740	-	Standard Specification for Methyl Ethyl Ketone
ASTM D746	-	Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact
ASTM D903	-	Standard Test Method for Peel or Stripping Strength of Adhesive Bonds
ASTM D1084	-	Standard Test Methods for Viscosity of Adhesives
ASTM D1153	-	Standard Specification for Methyl Isobutyl Ketone
ASTM D1298	-	Standard Test Method for Density, Relative Density, or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method
ASTM D2240	-	Standard Test Method for Rubber Property - Durometer Hardness

(Copies of these documents are available online at https://www.astm.org/).

SAE INTERNATIONAL STANDARDS / Aerospace Material Specifications

SAE-AMS-QQ-A-250/4	-	Aluminum Alloy 2024, Plate and Sheet

(Copies of these documents are available from https://www.sae.org).

2.4 Order of precedence. Unless otherwise noted herein or in the contract, 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 their 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.

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

Property	Requirements			Test Paragraph
	Group I		Groups I & 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 (poise)	---	150 - 550	---	4.5.3.2.4
Tack free time (hours)	5.0	5.0	5.0	4.5.3.2.5

3.3.1.1 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).

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.l) tensile strength (3.3.2.1), elongation (3.3.2.1), and peel strength (3.3.2.l) 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.

TABLE II. Properties of cured silicone adhesive-sealant.

Property	Requirements			Test Method or Paragraph
	Group I		Groups I & 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)	(175) 1206	(150) 1034	(500) 3447	ASTM D412 (Die C)
Elongation percent (min)	300	150	500	ASTM D412 (Die C)
Peel strength, lb Aluminum lb/in, (min kg/max, (min) Steel lb/in, (min) kg/max, (min)	 15 0.3 15 0.3	 4 0.1 4 0.1	 40 0.7 40 0.7	4.5.3.2.7

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, except that the tensile strength and elongation for Group II material shall be 250 psi (min) and 300 percent (min), respectively. Group III material after exposure for 72 ± 4 hrs (3 days ± 4 hrs) at 600 ± 4 °F (316 ± 2°C) shall have a hardness, Shore A (Durometer) of 60 max, tensile strength of 200 psi, min (1379 kPa) 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 III. Electrical properties.

Property	Requirements Groups 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:

3.4.1.1 Application. One-component moisture cure adhesive-sealants require the following application conditions:

a. Good ventilation during cure.
b. Full cure before enclosure (7 days minimum for thicknesses over 0.125 inch (3.2 mm), and 14 days minimum for thicknesses over 0.25 inch (6.4 mm)).
c. Sufficient moisture to complete cure.
d. Maximum thickness of 0.50 inch (12.7 mm).
e. Maximum glueline of 1.0 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.

PRECAUTION: The Surgeon General requires airline respirators to be used unless air sampling shows exposure to be below standards. Then, either chemical cartridge respirators or airline respirators are required. Avoid contact with skin and eyes. Use with adequate ventilation. For other safety recommendations refer to the Safety Data Sheet (SDS). Keep containers closed.

3.5 Toxicity clearance. All new chemicals and materials being added to the Army supply system shall have a toxicity clearance. A toxicity clearance involves a toxicological evaluation of materials prior to introduction into the Army supply system. The Army program manager shall be responsible for identifying technically feasible materials and requesting a toxicity clearance for use of that material within their program (see 6.10).

3.6 SDS. The manufacturer shall comply with the requirements as specified in the OSHA Brief:

(http://www.osha.gov/dsg/hazcom/osha-brief.html).

and, as specified in Appendix D of 29 CFR 1910.1200 see:

(https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.1200AppD).

A SDS shall be prepared for the material in accordance with FED-STD-313 and forwarded to the qualifying activity (see 6.9). The SDS shall be included with each shipment of the material covered by this specification and submitted to pertinent Government agencies as stated in FED-STD-313.

3.7 Ozone depleting substances. Class I and II ozone depleting substances (ODS) shall not be used in MIL-DTL-46146 or any referenced procedures.

3.8 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.

3.9 Records. The contractor shall maintain records of the testing results data collected for the adhesive-sealants with the period of record retention specified in the contract or purchase order.

4. VERIFICATION

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 their 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 MIL-STD-1916 and surveyed in accordance with level I of ANSI/ASQ Z1.4.

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).

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.

TABLE IV. Classification of detects.

Item	Classification of defect	Defect	Method of inspection
Silicone adhesive-sealant (see 4.3.1, 3.2.1, and 3.6)	Critical	None defined	
	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 104	Not homogeneous	Visual
	Major 104	Contains foreign matter 1/	Visual

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

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 6.0 inches (152 mm) long by 4.0 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. 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.
f. 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 1/ (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.

1/ Ozalid type reproduction paper is no longer in widespread production and procedure A is recommended.

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 ± 4°F (23 ± 2°C) and 50 ± 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 ± 4°F (23 ± 20C) and 50 ± 5 percent relative humidity for 168 ± 4 hours (7 days ± 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 tables 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	3.3.1.1.2	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

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		4.5.3.2.5
Corrosion 1/, 2/	3.3.1.1 (a)	3.3.1.1 (a)	3.3.1.1 (a)	4.5.3.2.6.1

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 4.5.3.2.6) certifying that the sealing adhesive-sealant shall meet the corrosion test requirements of 3.3.1.1.

2/ Quality conformance inspection, for corrosion and dielectric strength, on lots of silicone adhesive-sealant, which are run in a continuous basis, shall be made at least every four months during manufacturer's test inspection.

TABLE VI. Quality conformance inspection - Continued.

Test Characteristic	Requirements			Test Method
	Group I	Group II	Group III	
Cured compound				
Hardness	3.3.2.1	3.3.2.1	3.3.2.1	ASTM D2240
Tensile strength	3.3.2.1	3.3.2.1	3.3.2.1	ASTM D412 (Die C)
Elongation	3.3.2.1	3.3.2.1	3.3.2.1	ASTM D412 (Die C)
Peel strength	---	3.3.1	---	4.5.3.2.7
Dielectric strength 2/	3.3.1	3.3.1		ASTM D149

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 ± 20C) 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 glycerin (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 (it 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.

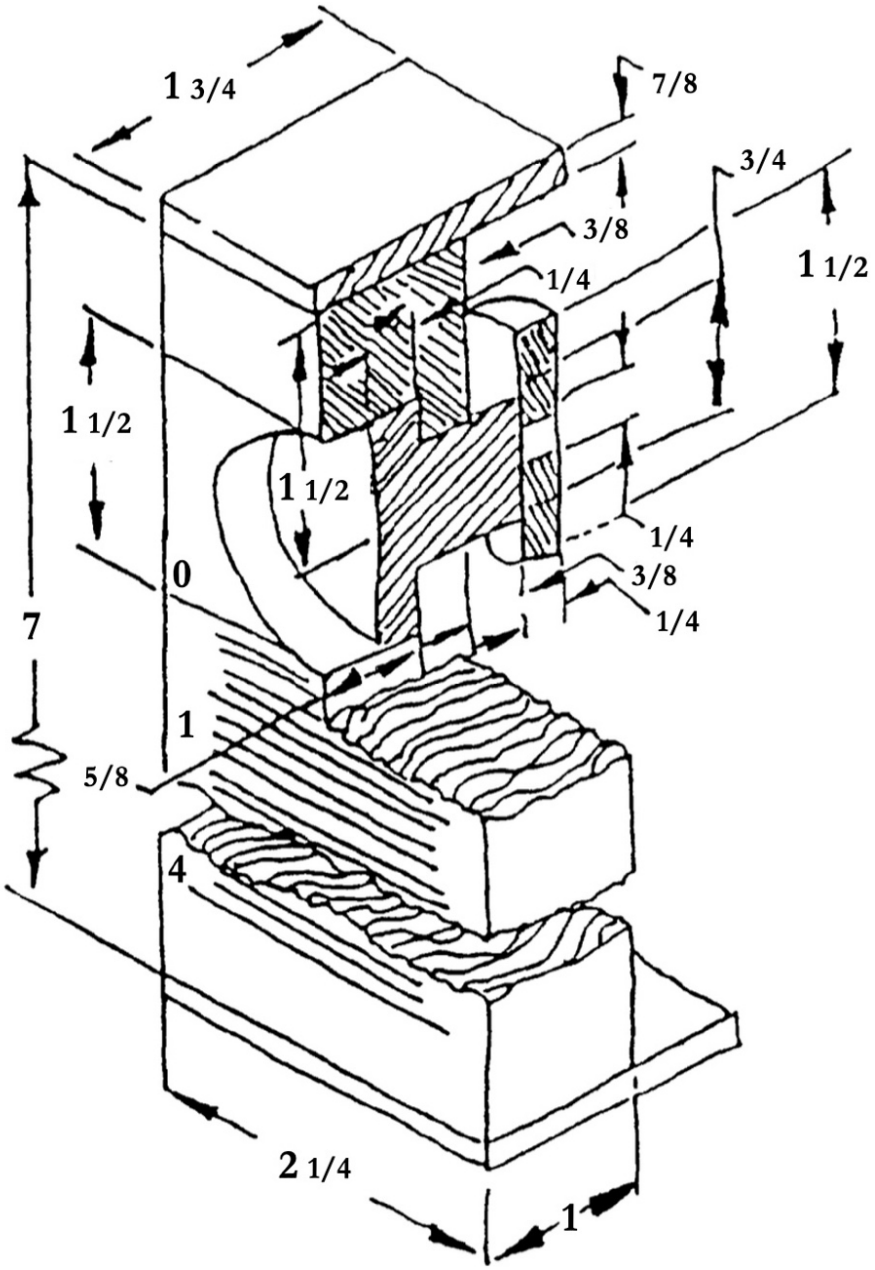
4.5.3.2.1 Total solids (silicone adhesive-sealant). Three specimens shall be tested and results averaged. Each specimen shall be tested as follows: Transfer 5 to 10 grams of the uncured silicone adhesive-sealant as rapidly as possible to a cup approximately 3.0 inches (76 mm) in diameter and 0.75 inch (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 silicone adhesive-sealant for 24 ± 1 hour at 158 ± 4°F (170 ± 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 sealants 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 at 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 0.125 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 at 90 ± 5 psi (620 ± 10 kPa) for line variation or gage error. From 2.0 - 3.0 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.

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 tor 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.



Notes.
1/ Material: Aluminum Alloy
2/ Dimensions in inches. Unless otherwise specified, tolerances ±0.003 in.

FIGURE 1. Flow test jig.

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 1.0 inch by 6.0 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 0.5 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 4.0 inches by l.0 inch (102 mm by 25 mm) shall be prepared for each of the following metals: Copper alloy conforming to number or composition 230 of ASTM B16, steel conforming to ASTM A794/A794M, and aluminum conforming to ASTM B209/B209M. 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 1.50 inches (38 mm) lengths of AWG 12 size copper wire conforming to A-A-59544 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 1.0 inch by 2.0 inch by 0.25 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 1.50 inches (38 mm) 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.lb.

4.5.3.2.6.3 Corrosion of steel and aluminum by direct contact. Panels approximately 4.0 inches by 1.0 inch (102 mm by 25 mm) of steel and aluminum conforming to ASTM A794/A794M and SAE-AMS-QQ-A-250/4, respectively, shall be cleaned with steel wool or number 400 emery cloth, rinsed with acetone and blotted dry. Coat approximately 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 0.063 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 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 steel strip. Clean the panel and the steel strip with methyl isobutyl ketone (MIBK) or methylethylketone (MEK) and cotton gauze, (cheesecloth). Rub vigorously to insure both are fully 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. Prime 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 0.063 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 0.25 x 0.010 x 12 inches (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 0.063 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 2.0 inches (50.8 mm per minute).

4.5.3.2.8 Storage life. Unless otherwise specified (see 3.6) 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 4.5.1.2.9) that the sealing adhesive-sealant and primers (if required) shall meet the storage life requirements specified in 3.3.1.2.

4.5.4 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.

4.5.5 Reporting of tests. When required in the contract or purchase order, the results of all tests and retests made on silicone adhesive-sealant shall be recorded and retained for the period of record retention that was cited (see 3.9). Results shall be provided to the Government procuring activity, the Contracting officer, or the Government representative as necessary (see also 3.9, 6.2.2, and 6.2.2.1).

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or purchase order (see 6.2). When packaging of materiel components is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible

packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Service or Defense Agency, or within the military service's system commands. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

5.1.1 Packaging notes. Due to the substantial passage of time since the last revision of this specification, additional packaging information that may be helpful including past definitions and procedures for unit of product, sampling, packaging inspection, and exterior container markings are included in 6.8 and its sections therein. This legacy content will be deleted in the next revision or amendment to this specification.

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 specialty uses as well as to production line methods. As these materials are noncorrosive to copper and other sensitive metals they remain widely accepted 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 Fluid Resistance warning. These silicone adhesive-sealants are not resistant to many types of fluids such as fuel and hydraulic fluids. This statement should be used as applicable and if required as described in 6.8.3.

6.1.2 Thickness and glue lines. With one-component adhesive sealants requiring moisture from the air to cure, the thicknesses should be limited to 0.5 inch (13 mm), and the glue lines limited to l.0 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. 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. 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 1.3 and 6.4).

f. Container size for silicone adhesive-sealant and primer (see 1.3 and 6.4).

g. Levels of preservation and packing required (5.1 and 6.8).

h. Palletization required (5.1 and 6.8).

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).

k. Preparation of SDS in accordance with FED-STD-313 for the adhesive and inclusion of SDS with shipment of material (see 3.6 and 6.9).

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 (DIDs) should be reviewed in conjunction with the specific acquisition to ensure that only essential data are requested/provided and that the DIDs 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. When the DD Form 1423 is not used, the data specified below should be delivered by the contractor in accordance with the contract or the purchase order requirements. Deliverable data required by this specification is cited in table VII:

TABLE VII. Required deliverable data.

PARAGRAPH NO.	DATA REQUIREMENT TITLE	APPLICABLE DID No. 1/
3.3.3	Certification Data Report	DI-MISC-82386

1/ Copies of data item descriptions related to this specification will be approved and listed as such in DOD 5010.12, Acquisition Management Systems and Data Requirements Control List (AMSDL). Copies of data item descriptions required by the contractors in connection with specific acquisition functions are available online at https://quicksearch.dla.mil/.

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 should 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 not applicable, the report should 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 required 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 breaks out the military part number or identifying number (PIN) coding (see 1.3) for one component silicone RTV products that correspond to the varieties covered by this specification.

TABLE VIII. Military part number coding.

Group	Code	Type	Code	Size	Code	Color	Code	Primer Required	Code
I	1	I	1	3 oz. tube	A	White	W	Yes	Y
II	2	II	2	5 oz. tube	B	Translucent	T	No	N
III	3			6 oz. cartridge	C	Gray	G		
				12 oz. cartridge	D	Other	O		
				1 pint	E				
				5 gallon pail	F				
				50 gallon drum	G				

6.5 Trade name. Dupanol WAQ, also known as sodium dodecyl sulfate, is an industrial surfactant manufactured by E.I. Dupont de Nemours & Co., Inc., Wilmington, Delaware 19807. Additional information on this chemical solution and its common generic naming is available online at:

(https://www.pharmacompass.com/chemistry-chemical-name/dupanol-waq).

6.6 Toxicity. Toxicity information on silicone adhesive-sealant and its primers is available in the SDS (see 3.6). Additional 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. Each manufacturer offers their own colors for silicone compounds. These colors, not all exclusive to one manufacturer, include white, translucent, gray, and possible other colors (red, blue, black). The silicone adhesive-sealant colors may or may not indicate specific usage functions. When ordering silicone adhesive-sealants, the users and procurement officers should deliberately verify that the prospective silicone adhesive-sealant product selection will meet mission requirements and should not assume that it will based solely upon the product's color.

6.8 Packaging considerations. Due to the substantial length of time since the last revision of this specification, additional packaging information including past definitions and procedures for unit of product, sampling, and packaging inspection are included as a courtesy in this section.

6.8.1 Inspection of packaging. Except when commercial packaging is specified, the sampling and inspection of the preservation and interior package marking should be in accordance with 3.4 and

the contract or purchase order. Sampling and inspection of the packing for shipment and storage in accordance with the quality assurance provisions in section 5 and inspection of marking for shipment and storage should be in accordance with MIL-STD-129.

6.8.2 Quality conformance inspection of pack.

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

6.8.2.2 Sampling. Sampling for examination should be in accordance with MIL-STD-1916.

6.8.2.3 Examination. Samples selected in accordance with 6.9.2.2 should be examined for the defects indicated in table VII. The presence of one or more defects should be cause for rejection.

6.8.3 Exterior container marking details. In addition to any special marking required by the contract or order herein, interior and exterior shipping containers should be marked in accordance with MIL-STD-129 for military levels of protection. A label should be attached to each exterior container of silicone adhesive-sealant and primer (if required) with additional data as follows so that traceability of the lot can be verified:

a. Number and title of this specification.
b. Adhesive-sealant group and type.
c. Dates of manufacture and reinspection.
d. Cure time if other than that specified (see 4.5.2.2).
e. WARNING: relative to toxicity (see 3.5 and 6.10).
f. WARNING: as to fluid resistance (see 6.1.1)
g. Label attached to containers of silicone adhesive-sealant should contain application instructions for adhesive-sealant and primer (see 3.4).
h. Each unit container of primer should be marked as follows:

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

i. WARNING: FAILURE TO USE RECOMMENDED PRIMER ON SOME METALS MAY RESULT IN ADHESION FAILURE."

6.9 SDS. Contracting officers should identify those activities requiring copies of a completed SDS, when implemented, prepared in accordance with FED-STD-313. The pertinent Government mailing addresses for submission of data are listed in FED-STD-313.

6.10 Toxicity clearance request. Department of the Army Regulation (AR) 40-5, Preventive Medicine, (AR) 70-1, Acquisition Policy, and Department of the Army Pamphlet 70-3, Acquisition Procedures, require a toxicity clearance. Army toxicity questions and/or a toxicity clearance request should be addressed to: DHA Public Health, ATTN: DCPH-ATS-TOX, 8300 Ricketts Point Road, APG-EA, MD 21010-5403 or emailed to dha.apg.Pub-Health-A.mbx.tox-info@health.mil.

6.11 Subject term (key word) listing.

Adhesion	Cure	One-component
Bonding	Gaskets	Sealing

6.12 Supersession data. This specification supersedes the following military specifications:

a. MIL-A-46146B w/Amendment 3, 28 October 1992.

b. MIL-R-47211A (MI) 21 September 1989 - Type III only.

6.13 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extent of the changes.

CONCLUDING MATERIAL

Custodians:
Army - MR
Navy - AS
Air Force - 20

Preparing activity:
ARMY - MR

(Project 8040-2025-003)

Review activities:
Army - AR, AT, CE, EA, MI, SM
Navy - OS, SH, YD

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at https://assist.dla.mil/.