INCH-POUND
MIL-DTL-47113C
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SUPERSEDING
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DETAIL SPECIFICATION

COMPOUND, HEAT SINK, SILICONE AND/OR NON-SILICONE

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

1. SCOPE

1.1 Scope. This specification covers a silicone and/or non-silicone heat sink compound which is applied to the base and mounting studs of transistors and diodes to provide a positive heat sink seal.

1.2 Classification. The heat sink compound will be of the following types, as specified (see 6.2):

Type I - Silicone compound.
Type II - Non-Silicone compound.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Defense Supply Center Richmond (DSCR), ATTN: DSCR-VBD, 8000 Jefferson Davis Highway, Richmond, VA 23297-5610 by using Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A FSC 6850

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements documents cited in sections 3 and 4 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 Specification and standard. The following specification and standard form a part of this document to the extent specified herein. Unless otherwise specified, the issue 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).

SPECIFICATION

FEDERAL

VV-D-1078 - Damping Fluid, Silicone Base (Dimethyl Polysiloxane)

STANDARD

FEDERAL

FED-STD-791 - Methods of Testing Lubricants, Liquid Fuels and Related Products

(Unless otherwise indicated, copies of the above specification and standard are available from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094).

2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DOD adopted are those listed in 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 D70 - Specific Gravity and Density of Semi-Solid Bituminous Materials (DOD Adopted)
ASTM D217 - Cone Penetration of Lubricating Grease (DOD Adopted)

(Application for copies of ASTM publications should be addressed to the American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.)

2.4 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 Toxic chemicals, hazardous substances, and ozone depleting substances (ODS). The use of toxic chemicals, hazardous substances, or ODS shall be avoided, whenever feasible.

3.2 Recycled, recovered, or environmentally preferable materials. Recycled, recovered, or environmentally preferable materials should be used to the maximum extent possible provided that the material meets or exceeds the operational and maintenance requirements, and promotes economically advantageous life cycle costs.

3.3 First article. When specified (see 6.2), a sample shall be subjected to first article inspection in accordance with 4.3.

3.4 Material. The compound shall be an opaque white grease-like compound and conform to the applicable chemical characteristics of table I.

TABLE I. Chemical characteristics.

Chemical requirement	Type	
	Type I	Type II
Base fluid	Dimethyl polysiloxane[1]	Polyol ester
Filler/other materials	99% min., Zinc oxide	Zinc oxide, Aluminum silicate
Specific gravity, 25°C, min.	2.0	2.0
Penetration - Consistency	250-320	250-320
Bleed, 24 hrs., %/Wt, max.	1.0	1.0
Evaporation, 24 hrs., %/Wt, max.	2.0	2.0
Thermal conductivity, g-cal(cm)/sec/cm^2/°C, min.	0.0005	0.0005

Note: [1]Dimethyl polysiloxane used in this silicone compound shall meet the requirements of Federal Specification VV-D-1078 with appropriate viscosity grade so that it shall meet the requirements of table 1.

3.5 Workmanship. The compound, as packaged in containers, shall be a smooth, homogeneous mixture, free from lumps, coarse particles, and foreign material. There shall be no separation of filler which cannot be readily redispersed.

4. VERIFICATION

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

a. First article inspection (see 4.3).

b. Conformance inspection (see 4.4).

4.2 Inspection conditions. Unless otherwise specified, all inspections shall be performed in accordance with the following test conditions:

a. Temperature, room ambient ± 9°C (± 16°F).

b. Altitude, facility ground.

c. Humidity, facility ambient up to 95 percent relative humidity.

4.3 First article inspection. When specified in the contract (see 6.2), a sample consisting of 4, 6, or 8 fluid ounces in sealed tubes or cans shall be subjected to first article inspection. If the first article sample does not meet the requirements of this specification, it shall be rejected. Subsequent units shall not be considered for acceptance until Government approval of the first article sample has been obtained. Testing of the first article sample, to determine compliance with the characteristics shown in 3.4 and 3.5, shall be conducted in accordance with 4.5.

4.4 Conformance inspection. Conformance inspection shall be performed in accordance with inspection provisions set forth herein. The characteristics shown in 3.4 and 3.5, when tested in accordance with 4.5, shall constitute minimum inspections to be performed by the supplier prior to Government acceptance or rejection. Failure of any test, by any sample, shall be cause for rejection. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of assuring that all products or supplies, submitted to the Government for acceptance, comply with all requirements of the contract.

4.5 Test methods.

4.5.1 Component and material inspection. In accordance with 4.4, components and materials shall be inspected in accordance with all of the requirements of referenced documents unless otherwise excluded, amended, modified, or qualified in this specification or applicable purchase document.

4.5.2 Tests.

4.5.2.1 Composition and workmanship. The composition shall be certified by the supplier and the condition in the container shall be determined visually to conform to 3.4 and 3.5 (see 6.2).

4.5.2.2 Specific gravity. Determine the specific gravity of the sample in accordance with ASTM D70 and verify the result with table I.

4.5.2.3 Penetration. Determine the penetration of the sample in accordance with ASTM D217. The test shall be run 1 minute after working and the results shall conform to table I.

4.5.2.4 Bleed. Determine the bleed of the sample in accordance with FED-STD-791, Method 321 with the following exceptions:

a. The cone shall be suspended from a rod supported on the edges of the beaker without covering the beaker.

b. The test shall be conducted at 200 ± 0.5°C (392 ± 1°F) for at least 24 hours.

Calculate the percent by weight as follows:

$$\text{Percent Bleed} = \frac{\text{Gain in weight of beaker}}{\text{Weight of sample}} \times 100$$

Verify the percent bleed with table I.

4.5.2.5 Evaporation. Determine the evaporation of the sample via the procedure given in 4.5.2.4. Calculate the percent evaporation loss of the sample as follows:

$$\text{Percent evaporation loss} = \frac{(S\text{-}Wt)}{S} \times 100$$

Where: S = initial weight of sample, gram
Wt = weight of sample after heating, gram

Verify the percent evaporation loss with table I.

4.5.2.6 Thermal conductivity. Determine the thermal conductivity of the sample using the hot wire method as follows:

4.5.2.6.1 Equipment.

a. Conductivity cell in accordance with figure 1.

b. Voltmeter 0-1.5 volts.

c. Ammeter 0-5 amperes.

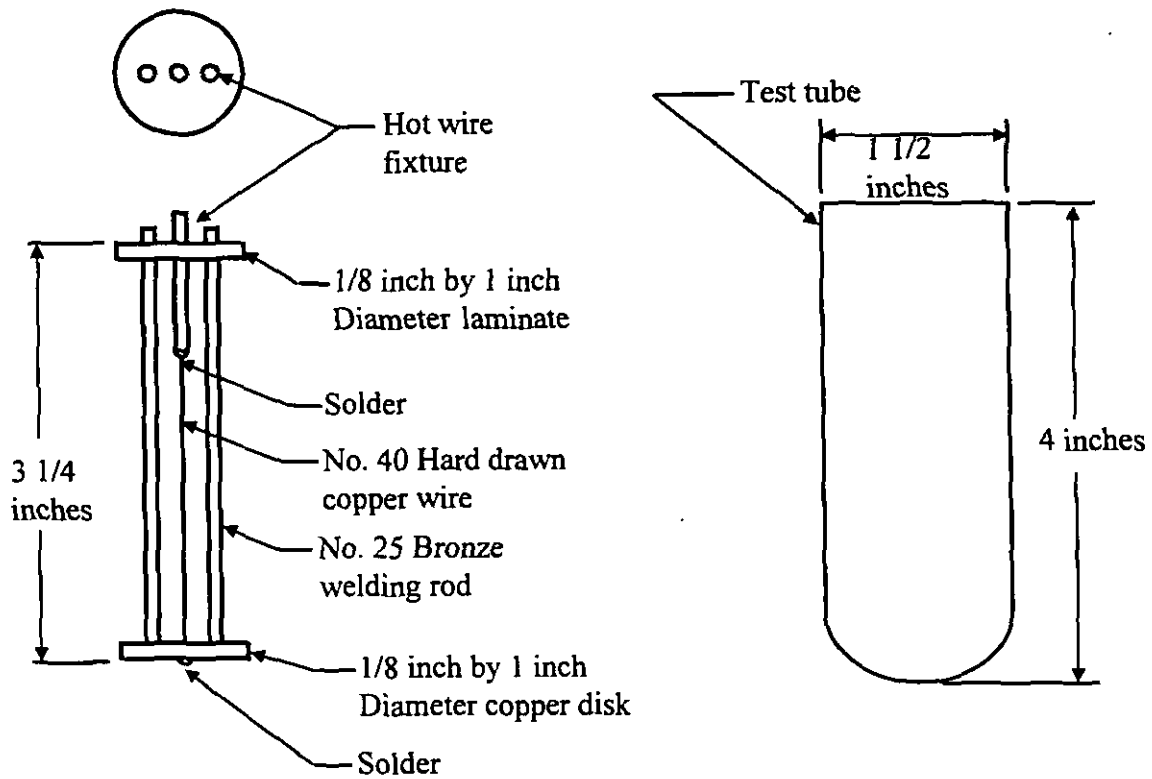

FIGURE 1. Thermal conductivity test - hot wire method.

4.5.2.6.2 Hot wire method.

a. Fill sample into a sample tube to within 0.75 inch of the top.

b. Insert hot wire fixture into the sample tube until the level of the sample is at the same level as the top-insulating disc.

c. Place the tube containing the sample and fixture into a 400-mL beaker containing water maintained at 23 ± 1°C (73 ± 2°F).

d. When the tube and the sample reach 23 ± 1°C (73 ± 2°F), the voltage shall be raised to 1.3 volts, provided current flow does not exceed 4 amperes.

e. The voltage shall be allowed to continue until current is stabilized. Record the voltage and current readings using the diagram in figure 2.

f. Reduce the voltage by 0.1 volt and wait for 2 minutes. Record the current flow.

g. Repeat step f. until 0.5 volt is reached.

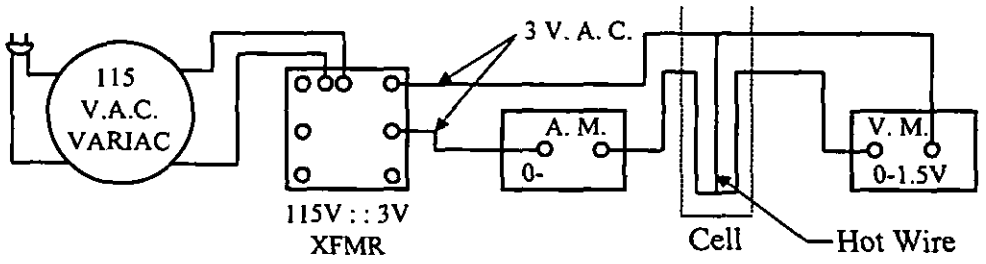

FIGURE 2. Thermal conductivity test diagram.

h. Calculate the circuit resistance, R_c, as follows:

$$\text{Circuit resistance } R_c = \frac{E}{I}$$

Where: E = voltage (volts)
I = current (amperes)

i. Calculate the watts, W, as follows:

$$\text{Watts } W = EI$$

j. Calculate the temperature in centigrade, T, as follows:

$$T = \frac{(R_c \times 257)}{R_e} - 234.5$$

Where: R_c = circuit resistance
R_e = resistance of wire at 23°C (73°F). Resistance shall be measured by means of a bridge. Resistance of test leads shall be subtracted when determining resistance of wire.

k. Plot the temperature versus watts and calculate slope (W/T).

l. Calculate the thermal conductivity, K, as follows:

$$\text{Thermal conductivity, } K = \frac{0.00038}{0.022} \times \text{slope}$$

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When actual packaging of material is to be performed by DOD personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity within the Military Department or Defense Agency, or within the Military Department's System Command. 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.

6. NOTES

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

6.1 Intended use.

6.1.1 General. The material covered by this specification is intended for use in improving thermal conductivity at heat sink junctions.

Caution: When this material is initially applied under devices which are torque set, the zinc oxide filler may not allow complete seating of the device. The following procedure should be used:

Apply a thin film of silicone/non-silicone grease, then torque to the pressure specified on the device detail drawing; after 20-30 minutes, retorque to specified pressure.

6.1.2 Military unique. The silicone and/or non-silicone heat sink compound tests covered by this specification are not standard tests for commercial products in the market. In order to meet the requirements of this specification, the vendor will have to run additional tests on their product.

6.2 Acquisition requirements. Acquisition documents should specify the following:

a. Title, number, and date of this specification.
b. Type required (see 1.2).
c. Issue of DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.2 and 2.3).

d. Whether a first article sample is required, and if so, pertinent details (see 3.3 and 4.3).
e. Requirement for certification of composition (see 4.5.2.1).
f. Packaging requirements (see 5.1).

6.3 Part or identifying number (PIN). The PIN to be used for heat sink compound acquired to this specification is created as follows:

M	47113	X	X
Prefix for military part number	Specification number	Type (see 1.2)	Container size

6.4 Subject term (key word) listing.

Amalgamate
Mixture
Thermal

6.5 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.

Custodians:
Air Force - 68
Navy - SH

Preparing activity:
DLA - GS
(Project 6850-1213)

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.
2. The submitter of this form must complete blocks 4, 5, 6, and 7.
3. The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

I RECOMMEND A CHANGE:	1. DOCUMENT NUMBER	2. DOCUMENT DATE *(YYMMDD)*
	MIL-DTL-47113C	990412

3. DOCUMENT TITLE

COMPOUND, HEAT SINK, SILICONE AND/OR NON-SILICONE

4. NATURE OF CHANGE *(Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)*

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME *(Last, First, Middle Initial)*	b. ORGANIZATION	
c. ADDRESS *(Include Zip Code)*	d. TELEPHONE *(Include Area Code)* (1) Commercial (2) AUTOVON *(If applicable)*	7. DATE SUBMITTED *(YYMMDD)*

8. PREPARING ACTIVITY

a. NAME	b. TELEPHONE *(Include Area Code)* (1) Commercial	(2) AUTOVON
c. ADDRESS *(Include Zip Code)*	**IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT:** Defense Quality and Standardization Office 5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466 Telephone (703) 756-2340 AUTOVON 289-2340	