

INCH-POUND

MIL-PRF-47009C
21 January 2000
SUPERSEDING
MIL-C-47009B(MI)
30 June 1989

PERFORMANCE SPECIFICATION
COMPOUND, SILICONE, HEAT SINK

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

1. SCOPE

1.1 Scope. This specification covers four types of one-part, ready to use, silicone heat sink compound.

1.2 Classification. The heat sink compound will be furnished in the following types (see 6.2).

Type I - Thermal conductivity 0.0017 gram-calorie per square centimeter per degree Centigrade per second per centimeter ($\text{gm-cal/cm}^2/^{\circ}\text{C/sec/cm}$), minimum.

Type II - Thermal conductivity 0.0010 $\text{gm-cal/cm}^2/^{\circ}\text{C/sec/cm}$, minimum.

Type III - Thermal conductivity 0.0005 $\text{gm-cal/cm}^2/^{\circ}\text{C/sec/cm}$, minimum.

Type IV - Thermal conductivity 0.0008 $\text{gm-cal/cm}^2/^{\circ}\text{C/sec/cm}$, minimum.

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 the Standardization Document Improvement Form Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A

FSC 6850

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

MIL-PRF-47009C

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 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 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 issue of the Department of Defense Index of Specifications and Standards (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) (see DODISS)

- ASTM C 177 - Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus, Standard Test Method for, (DoD Adopted)
- ASTM C 518 - Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus, Standard Test Method for, (DoD Adopted)
- ASTM D 149 - Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies, Standard Test Method for, (DoD Adopted)
- ASTM D 217 - Cone Penetration of Lubricating Grease, Standard Test Methods for, (DoD Adopted)
- ASTM D 257 - DC Resistance or Conductance of Insulating Materials, Standard Test Methods for, (DoD Adopted)
- ASTM D 972 - Evaporation Loss of Lubricating Grease and Oils, Standard Test Method for, (DoD Adopted)
- ASTM D 1742 - Oil Separation from Lubricating Grease During Storage, Standard Test Method for, (DoD Adopted)
- ASTM D 1810 - Specific Gravity of Askarels, Standard Test Method for, (DoD Adopted)

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

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.

MIL-PRF-47009C

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 silicone compound, filled with heat-conductive metal oxides and conform to the requirements of table I.

TABLE I. Physical properties by type.

Properties	Type I	Type II	Type III	Type IV	Test Paragraph
Specific gravity, minimum	2.30	2.30	2.30	2.30	4.5.2
Penetration - Consistency	250-320	250-320	250-320	250-320	4.5.3
Bleed, 24 hrs. at 200°C, % maximum	1.500	0.500	0.500	1.500	4.5.4
Evaporation, 24 hrs. at 200°C, % maximum	1.500	1.000	1.000	1.500	4.5.5
Dielectric strength, volts/mil, minimum	300	300	300	300	4.5.6
Volume resistivity, Ohm-cm, minimum	5×10^{14}	5×10^{14}	5×10^{14}	5×10^{14}	4.5.7
Thermal conductivity gm-cal(cm ²)/°C/sec/cm, minimum	0.0017	0.0010	0.0005	0.0008	4.5.8

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 (see 4.5.1).

3.6 Storage stability. When stored in unopened containers at 15 to 35°C (59 to 95°F), for a period of not less than 1 year from date of shipment, the compound shall meet all requirements of

MIL-PRF-47009C

this specification. A written certification by the supplier, attesting to conformance to specified storage life conditions, shall satisfy this requirement (see 4.5.1).

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 test conditions specified below.

- a. Temperature, 22°C to 27°C.
- b. Relative humidity, 60 percent maximum.
- c. Barometric pressure, 28 to 32 mm of mercury.

4.3 First article inspection. When specified in the contract (see 6.2), a sample of a quantity of the heat sink compound sufficient to conduct all tests specified herein shall be subjected to first article inspection. The first article sample shall be fabricated using the same processes, facilities, and materials as are proposed for production. 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, 3.5 and 3.6 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, 3.5 and 3.6, 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 Composition, workmanship and storage stability. The composition shall be certified by the supplier and the condition in the container shall be determined visually to conform to 3.4, 3.5 and 3.6 (see 6.2).

MIL-PRF-47009C

4.5.2 Specific gravity. Determine the specific gravity of the sample in accordance with ASTM D 1810.

4.5.3 Penetration. Determine the penetration of the sample in accordance with ASTM D 217.

4.5.4 Bleed. Determine the bleed of the sample in accordance with ASTM D 1742.

4.5.5 Evaporation. Determine the evaporation of the sample in accordance with ASTM D 972.

4.5.6 Dielectric strength. Determine the dielectric strength of the sample in accordance with ASTM D 149.

4.5.7 Volume resistivity. Determine the volume resistivity of the sample in accordance with ASTM D 257.

4.5.8 Thermal conductivity. Determine the thermal conductivity of the sample in accordance with ASTM C 177 or ASTM C 518.

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. Application. The material covered by this specification is intended for use in applications requiring heat transfer from circuit devices to substrates (heat sinks, chassis, and related items) where efficient cooling is required. All types have the same specific gravity, penetration-consistency, dielectric strength and volume resistivity. The types differ in bleed, evaporation and thermal conductivity.

MIL-PRF-47009C

6.1.2. Military Unique. Some of the applications for which the heat sink compound is intended require it to be used in military unique environments of extreme temperature ranges and shock and vibration levels.

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).
- 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 4.5.1).
- f. Packaging requirements (see 5.1).
- g. Part or identifying number (PIN) (see 6.3).

6.3 Part or identifying number (PIN). The following part identification numbering procedure is for government purposes and does not constitute a requirement for the contractor. This example describes a part numbering system for specification MIL-PRF-47009C.



6.4 Subject term (key word) listing.

Amalgamate
Metal oxides
Thermal conductivity

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.

Custodian:
Army - MI

Preparing activity:
DLA - GS
(Project 6850-1436)

Reviewer:
Army - AR

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, and send to preparing activity.
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
MIL-PRF-47009C

2. DOCUMENT DATE (YYYYMMDD)
20000121

3. DOCUMENT TITLE **COMPOUND, SILICONE, HEAT SINK**

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
(YYYYMMDD)

8. PREPARING ACTIVITY

a. NAME DSCR-VBD

b. TELEPHONE *Include Area Code)*
(1) Commercial (804) 279-5019 (2) AUTOVON 695-5019

c. ADDRESS *(Include Zip Code)*
DEFENSE SUPPLY CENTER RICHMOND, ATTN: DSCR-VBD, 8000
JEFFERSON DAVIS HIGHWAY, RICHMOND, VA 23297-5610

IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT:
Defense Standardization Program Office (DLSC-LM)
8725 John J. Kingman road, Suite 2533, Ft. Belvoir, VA 22060-2533
Telephone (703) 767-6888 AUTOVON 427-6888