

NOT MEASUREMENT SENSITIVE
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MIL-PRF-47009D  
9 November 2006  
SUPERSEDING  
MIL-PRF-47009C  
21 January 2000

## 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 silicone heat sink compound is of the types indicated in table I (see 6.3). The unit for thermal conductivity is gram-calorie per square centimeter per degree Celsius per second per centimeter ( $\text{gm-cal/cm}^2/^{\circ}\text{C/sec/cm}$ ).

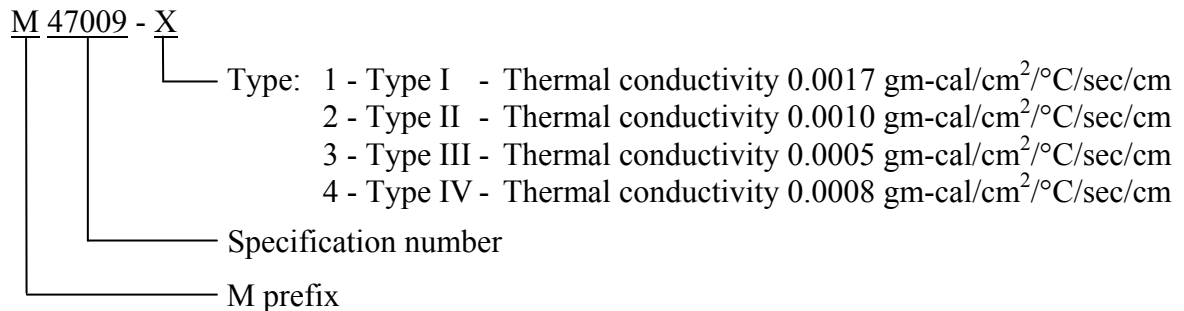
TABLE I. Types of silicone heat sink compound.

Type	Thermal conductivity (minimum)
I	0.0017
II	0.0010
III	0.0005
IV	0.0008

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



## 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 of the 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 these documents are those cited in the solicitation or contract (see 6.3).

### ASTM INTERNATIONAL

ASTM C 177	- Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
ASTM C 518	- Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
ASTM D 70	- Standard Test Method for Density of Semi-Solid Bituminous Materials (Pycnometer Method).
ASTM D 149	- Standard Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies.
ASTM D 217	- Standard Test Methods for Cone Penetration of Lubricating Grease.
ASTM D 257	- Standard Test Methods for DC Resistance or Conductance of Insulating Materials.
ASTM D 972	- Standard Test Method for Evaporation Loss of Lubricating Greases and Oils.

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ASTM INTERNATIONAL - Continued.

- ASTM D 1742 - Standard Test Method for Oil Separation from Lubricating Grease During Storage.
- ASTM D 3142 - Standard Test Method for Specific Gravity, API Gravity, or Density of Cutback Asphalts by Hydrometer Method.

(Copies of these documents are available online at <http://www.astm.org/> or from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, 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.

### 3. REQUIREMENTS

3.1 First article. When specified (see 6.3), a sample shall be subjected to first article inspection in accordance with 4.3.

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 Materials. The compound shall be an opaque white grease-like silicone compound filled with heat-conductive metal oxides and conform to the requirements of table II (see 4.5.1).

TABLE II. Physical properties by type.

Properties	Type I	Type II	Type III	Type IV
Specific gravity, minimum	2.30	2.30	2.30	2.30
Penetration - consistency	250-320	250-320	250-320	250-320
Bleed, 24 hrs. at 200 °C, % maximum	1.500	0.500	0.500	1.500
Evaporation, 24 hrs. at 200 °C, % maximum	1.500	1.000	1.000	1.500
Dielectric strength, volts/mil, minimum	300	300	300	300
Volume resistivity, Ohm-cm, minimum	$5 \times 10^{14}$	$5 \times 10^{14}$	$5 \times 10^{14}$	$5 \times 10^{14}$
Thermal conductivity gm-cal/cm <sup>2</sup> /°C/sec/cm, minimum	0.0017	0.0010	0.0005	0.0008

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3.4 Workmanship. The heat sink compound, as packaged in containers, shall be a smooth homogenous mixture free from lumps, coarse particles, and foreign material. There shall be no separation of filler that cannot be readily redispersed (see 4.5.1).

3.5 Storage stability. When stored in unopened containers at 15 °C to 35 °C (59 °F to 95 °F), for a period of one year from date of shipment, the compound shall meet all requirements of 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 inspections. 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 millimeters (mm) to 32 mm of mercury.

4.3 First article inspection. When specified in the acquisition order (see 6.3), 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 3.3, 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 3.3, 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 acquisition order.

#### 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 3.3, 3.4, and 3.5 (see 6.3).

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4.5.2 Test methods. The silicone heat sink compound physical properties listed in table II shall be determined in accordance with the methods listed in table III.

TABLE III. Test methods.

Property	ASTM method
Specific gravity	D 70 or D 3142 <sup>1</sup>
Penetration - consistency	D 217
Bleed, 24 hours @ 200 °C	D 1742
Evaporation, 24 hours @ 200 °C	D 972
Dielectric strength	D 149
Volume resistivity	D 257
Thermal conductivity	C 177 or C 518

<sup>1</sup>Specific gravity shall be determined in accordance with the stated ASTM methods or other acceptable commercial test method.

## 5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.3). When packaging of materiel 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 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 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.

6.2 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.

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6.3 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, and date of this specification.
- b. Type (see 1.2).
- c. The specific issue of individual documents referenced (see 2.2).
- d. When first article is required (see 3.1 and 4.3).
- e. Certification of composition (see 4.5.1).
- f. Packaging requirements (see 5.1).

6.4 Subject term (key word) listing.

heat conductive  
metal oxide  
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 - GS3

(Project 6850-2006-009)

Review Activity:  
Army - AR

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