

MIL-I-46838B(MI)
 27 February 1981

 Superseding
 MIL-P-46838A(MI)
 10 March 1972
 (See Section 6)

MILITARY SPECIFICATION

INSULATING COMPOUND, ELECTRICAL, SILICONE RUBBER, ROOM TEMPERATURE VULCANIZING

This specification is approved for use by the US Army Missile Command, Department of the Army, and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers four types of room temperature vulcanizing, silicone rubber insulating compounds.

1.2 Classification. The insulating compounds covered by this specification shall be of the following types as characterized by their viscosities:

Type I	200 to 500 poises
Type II	200 to 600 poises
Type III	300 to 900 poises
Type IV	80 to 250 poises

1.3 Military part number. The military part number shall consist of the letter B, the basic number of this specification, and dash designation (the word TYPE and Number) from the classification (See 1.2):

Example: B46838- TYPE I

Basic number of MIL SPEC	Material type
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Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, US Army Missile Command, ATTN: DRSMI-RSDS, Redstone Arsenal, AL 35898, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

MIL-I-46838B(MI)

2. APPLICABLE DOCUMENTS

2.1 Issues of documents. The following documents of the issue in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein.

SPECIFICATIONS

FEDERAL

*	PPP-T-76	Tape, Packaging Paper, (For Carton Sealing)
	PPP-B-585	Boxes, Wood, Wirebound
	PPP-B-591	Boxes, Fiberboard, Wood-Cleated
	PPP-B-601	Boxes, Wood-Cleated, Plywood
	PPP-B-621	Boxes, Wood, Nailed and Lock-Corner
*	PPP-B-636	Box, Shipping, Fiberboard

MILITARY

*	MIL-P-116	Preservation, Packaging, Methods of
	MIL-S-23586	Sealing Compound, Electrical, Silicone Rubber, Accelerator Required

STANDARDS

FEDERAL

FED-STD-601	Rubber, Sampling and Testing
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MIL-I-46838B(MI)

MILITARY

MIL-STD-105 Sampling Procedures and Tables
for Inspection by Attributes

MIL-STD-129 Marking for Shipment and Storage

- * (Copies of specifications, standards, drawings, and publications required by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids, or request for proposal, shall apply.

AMERICAN SOCIETY FOR TESTING MATERIALS

- * ASTM D 149-75 Dielectric Breakdown Voltage and
Dielectric Strength of Electrical
Insulating Materials at Commercial
Power Frequencies, Test Method For
- * ASTM D 1084-63 Test for Viscosity of Adhesives,
Methods of
- *

(Copies of ASTM publications may be obtained from the American Society for Testing Materials, 1916 Race Street, Philadelphia, PA 19103.)

- * Institute of Printed Circuits

IPC-TM-650 Glass Transition Temperature
(TMA Method)

(Copies of IPC publications may be obtained from the Institute of Printed Circuits, 1717 Howard Street, Evanston, IL 60202.)

3. REQUIREMENTS

MIL-I-46838B (MI)

3.1 Preproduction sample. The preproduction sample, if required (see 6.2), shall meet all requirements of this specification.

3.2 Materials. The insulating compounds covered by this specification shall consist of an organo-polysiloxane polymer which, when mixed with catalyst, shall cure to a rubbery solid. Cure shall be effected by catalytic action and shall not depend upon solvent evaporation.

- * 3.2.1 Shelf life. The manufacturer of the insulating compounds shall certify that the potting compounds will meet all the requirements of this specification after 6 months storage from the date of receipt in the original unopened containers at a temperature not exceeding 26.7° Celsius (C) (80° Fahrenheit (F)).

3.3 Physical properties of uncured compounds. The uncured compounds, when mixed in accordance with the manufacturer's instructions shall meet the physical property requirements of table I.

3.4 Physical and electrical properties of cured compounds. After curing for 72 hours at 23.9° plus or minus 2.8°C (75° plus or minus 5°F), the insulating compound shall meet the physical and electrical property requirements specified in table II.

- * 3.5 Glass transition temperature (Tg). To be capable of meeting the requirements of this specification, the apparent Tg or softening point shall be as specified by the manufacturer. The test specimen shall be only correctly mixed, cured, and aged per the manufacturer's instruction. The test method shall be as specified in 4.6 or any other method that gives comparable results. (See 6.7).

3.6 Workmanship. The insulating compounds covered by this specification shall be homogeneous and free of foreign materials. Containers shall be clean, uniformly filled, well-sealed, and legibly marked.

4. QUALITY ASSURANCE PROVISIONS

★ Table I. Physical Properties of Uncured Insulating Compound

Properties to be tested	Conditioning procedure (see 4.5.2)	Property values				Test methods reference
		Type I	Type II	Type III	Type IV	
UNCATALYZED: Viscosity, average, minimum/maximum, poises	A	200/500	200/600	300/900	80/200	ASTM D 1084, method B
CATALYZED: Pot life, minimum, hours	A	0.5	0.5	0.5	0.5	MIL-S-23586

Table II. Physical Properties of Cured Insulating Compound

Property to be used	Conditioning procedure (see 4.5.2)	Property values, all types	Test methods reference
Hardness shore A, average minimum/maximum	A E-70/450+1/75 E-1/-65+1/75	35/70 35/70 35/70	FED-STD-601, method 3021
Tensile strength, average, minimum, pounds per square inch	A E-70/450+1/75 E-1/-65+1/75	300 150 300	FED-STD-601, method 4111
Tear strength, average minimum, pounds per inch	A	15	FED-STD-601, method 4211, die "B"
Elongation, average minimum, percent	A E-70/450 E-1/-65	100 75 100	FED-STD-601, method 4121
Dielectric strength, average, minimum, volts per mil, approx. 75 mil sheet	A	350	ASTM D 149 short-time method

MIL-I-46838B (MI)

- * 4.1 Responsibility for inspection. Unless otherwise specified in the contract, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract, 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 the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.2 Classification of inspection. The classification of inspection shall be as follows:

- (a) Preproduction inspection
- (b) Acceptance inspection

4.3 Preproduction inspection.

4.3.1 Preproduction sample. A preproduction sample to be inspected under this document shall be representative of the subsequent production and shall meet all the requirements as specified herein. Unless otherwise specified by the procuring activity (see 6.2), the preproduction sample shall consist of one catalyst-compound system for each type inspected.

4.3.2 Sampling. Sampling for preproduction inspection shall be specified by the procuring activity.

4.3.3 Examinations. The preproduction examination shall consist of all the acceptance examinations specified herein.

4.3.4 Testing. Preproduction testing to determine compliance with all the requirements of tables I and II shall be conducted in accordance with the corresponding test methods specified in tables I and II. Test specimens requiring cure shall be cured before testing, in accordance with 3.4, for the applicable cure time.

4.4 Acceptance inspection.

MIL-I-46838B(MI)

4.4.1 Lot size. Lot size shall not exceed that quantity of insulating compound produced in a single operation by the same manufacturer and manufactured in accordance with the same specification and specification revision. Each lot shall be composed of raw materials from homogeneous lots.

4.4.2 Sampling.

4.4.2.1 For examination. Sampling for examination shall be 100 percent of production except as specified in 4.4.2.1.1.

- * 4.4.2.1.1 Sampling for inspection of containers. Unless otherwise specified (see 6.2), a random sample of filled containers shall be selected in accordance with MIL-STD-105 at inspection level I and acceptable quality level of 2.5 percent defective to verify compliance with all requirements regarding fill, closure, marking, and other requirements not requiring tests.

4.4.2.2 For testing. Unless otherwise specified (see 6.2), testing shall be performed on a sample taken at random from each lot. The sample shall be of a size sufficient for the performance of the required tests and shall be marked with the manufacturer's name, product number, lot number, and supplier's warranty expiration date.

4.4.3 Examinations. Examination shall be conducted for the purpose of determining compliance with the requirements for shelf life, workmanship, preservation, packaging, packing, and marking.

4.4.3.1 Inspection of containers. Each sample-filled container shall be examined for defects of construction of the container and the closure for evidence of leakage and for unsatisfactory markings; each filled container shall also be weighed to determine the amount of contents.

4.5 Test methods and procedures.

MIL-I-46838B (MI)

4.5.1 Test specimens. Five test specimens shall be prepared in accordance with the respective test method requirements for each test specified in tables I and II. Test specimens requiring cure shall be cured before testing, in accordance with 3.4, for the applicable cure time. The acceptance testing requirements of table II may be waived at the discretion of the procuring activity when preproduction testing is required (see 6.2 and 6.5).

4.5.2 Conditioning. Specimens shall be conditioned as specified in tables I and II prior to testing.

4.5.2.1 Designation. The type of conditioning required shall be designated as follows:

Condition A: As received; no special conditioning.

Condition E: Temperature conditioning.

4.5.2.2 Procedures. The conditioning procedure required, with the exception of condition A, shall be indicated by the following combination of symbols.

- (a) A capital letter indicating the type of conditioning.
- (b) A number indicating the duration of the conditioning in hours.
- (c) A number indicating temperature in degrees Fahrenheit.

The numbers shall be separated from each other by a slant mark and from the capital letter by a dash. A sequence of conditions shall be denoted by the use of a plus (+) sign between successive conditions.

4.5.2.3 Conditioning tolerances. Unless otherwise specified, conditioning tolerances and additional testing information tolerances and additional testing information shall be as specified in table III.

MIL-I -46838B (MI)

- * 4.6 Glass transition temperature test. The apparent Tg or softening point temperature shall be determined in accordance with method 2.4.24 of IPC-TM-650 or a thermal analysis (TMA)* method (see 6.7) that utilizes a penetration probe. Standard loading rate, temperature rate, coolant and gas purge as operating parameters shall be stated and remain the same for all tests. The resultant Tg shall conform to that specified in accordance with 3.5.

*NOTE: Thermomechanical analysis test equipment manufactured by the Perkin-Elmer TMS-1 or the E. I. DuPont 941 TMA.

5. PACKAGING

- * 5.1 Preservation, packing, unitization and marking. Level A, B or commercial packaging. (See 6.2).

5.1.1 Level A.

- * 5.1.1.1 Unit packaging. The insulating compound and curing agent shall be unit packaged in accordance with method IA-5 of MIL-P-116. The base compound and the curing agent shall each be packaged as one unit with their respective containers into a fiberboard box conforming to type CF, class WR of PPP-B-636.
- * 5.1.1.2 Intermediate packaging. When intermediate packaging is required, unit packages shall be placed in a close-fitting container conforming to type CF, class WR of PPP-B-636 and closed as specified in 5.1.1.3.
- * 5.1.1.3 Closure of fiberboard boxes. Unless otherwise specified, containers conformed to type CF, class WR of PPP-PB-636 shall be closed with six strips of 2-inch tape conforming to PPP-P-76. These strips shall be applied using three on the top seams and three on the bottom seams. When the bottom of the container is closed with staples or adhesives, only three pieces of tape on the seams are required. The tape shall extend at least three inches onto each and every side panel. In instances where the end panel is less than three inches in depth, the tape shall extend to the full depth.

MIL-I-46838B(MI)

5.1.2 Level B. (See 6.4).

- * 5.1.2.1 Unit packaging. The compound and curing agent shall be unit packaged as specified in 5.1.1.1.
- * 5.1.2.2 Intermediate packaging. Unit packages shall be placed in a close-fitting intermediate container conforming to type CF, class WR of PPP-B-636 and closed as specified in 5.1.1.3.
- * 5.1.3 Commercial. Unless otherwise specified, preservation and packaging shall afford adequate protection against deterioration and physical damage during shipment from supply source to the first receiving activity for immediate use.

5.2 Packing.

- * 5.2.1 Level A. The compound and curing agent shall be packed in overseas type exterior containers conforming to one of the following specifications: PPP-B-585; PPP-B-591; PPP-B-601; or PPP-B621. The gross weight shall not exceed 200 pounds. The container shall be strapped in accordance with the applicable container specification.
- * 5.2.2 Level B. The compound and curing agent shall be packed in domestic-type exterior containers conforming to the one of the following specifications: PPP-B-585; PPP-B-591; PPP-B-601; or PPP-B-621. The gross weight shall not exceed 200 pounds.
- * 5.2.3 Commercial. The compound and curing agent packaged as specified in 5.1.1.1 shall be packed in commercial type shipping containers constructed to withstand normal transportation and handling abuse and shall be suitable for indoor storage for a period of 6 months.

5.3 Markings. Interior packages and exterior containers shall be marked in accordance with MIL-STD-129 as implemented by the using services.

TABLE III. Conditioning Tolerances and Testing Information

Conditioning procedure	Conditioning tolerances		Testing conditions	
	Time	Temperature	Temperature and tolerances	Remarks
E (low temperature)	-0, + 6 min.	+ 5 degrees F	73 + 10 degrees F or -65 + 5 degrees F as indicated.	Start test immediately after the cycling has been completed.
E (high temperature)	-0, + 6 min.	+ 10 degrees F	73 + 10 degrees F or 450 + 10 degrees F as indicated.	Start test immediately after the cycling has been completed.

MIL-I-46838B (MI)

6. NOTES

6.1 Intended use. The insulating compounds covered by this specification are intended primarily for use in potting and encapsulating electrical and electronic components.

6.2 Ordering data. Procurement documents should specify the following:

- (a) Title, number, and date of this specification.
- (b) Type of insulating compound, part number (see 1.2 and 1.3).
- (c) Whether or not a preproduction sample is required (see 3.1 and 4.3.1).
- (d) Whether acceptance testing requirements of table II are required (see 4.5.1).
- * (e) Selection of applicable levels of packaging (see section 5).
- (f) Applicable sampling plan and level of inspection (see section 4).

6.3 Engineering information.

6.3.1 Service temperature range. The insulating compounds covered by this specification are suitable for use throughout the temperature range minus 54° to 232°C (minus 65° to 450° F) within the physical limitations of the insulating compounds as indicated in table II.

6.3.2 Adhesion. Only weak adhesive bonds are formed between compounds covered by this specification and materials against which they may be molded. If an adhesive bond is desired, a silicone primer as recommended by the manufacturer may be used. When the primer is used, peel strenghts may be expected in the order of 3.5 pounds per inch.

6.4 Levels of protection. Level B preservation and packaging is intended to provide economical but limited protection and should be specified only when it is determined to be appropriate.

MIL-I-46838B (MI)

- * 6.5 Waiver of table II acceptance testing requirements. If preproduction testing is required by the procuring agency and the insulating compound is acceptable, the requirements specified in table II may be waived for acceptance inspection at the option of the procuring agency. These tests are of a tedious nature and could delay delivery. This testing could also increase cost for the material (see 4.5.1).
- 6.6 Packaging and shipping requirements. Packaging and shipping methods employed by industry or the vendor should be examined for adequacy and economy before a contract is let. Most manufacturers have adequate packaging and shipping procedures which comply with Interstate Commerce Commission regulations. This enables immediate shipments as no delay will result due to procurement of packaging materials.
- * 6.7 Thermomechanical analysis (TMA). Thermomechanical analysis (TMA) is a thermal technique for characterization and quality control of encapsulating and potting compounds. By measuring dimensional changes (expansion mode) or viscoelastic changes (penetration mode) properties such as coefficient of expansion, modulus, heat distortion and softening point can be determined precisely and rapidly on small samples in any form-powder, pellet, film, fiber or molded part. The measurements correlate well with the results of many ASTM physical tests. Compared with the ASTM test method, the TMA method is very rapid, requires a small amount of sample, is nondestructive to the manufactured item and the test equipment outlay is inexpensive. The Tg or softening point will vary or differ from one manufacturer to another according to the additives, modifiers, plasticizers, and catalysts. All of these variables cause changes in the cross linking of the polymer.
- * 6.8 Supersession data. This specification does not supersede MPD 9067 or Revisions thereto as previously indicated by the 25 June 1965 version of MIL-P-46838. MPD 9067 has been retained for use by the Army Pershing Missile System.
- 6.9 Changes to previous issue. The margins of this specification are marked with an asterisk to indicate where changes (additions, modification, corrections, deletions) from the previous issue were made. This was done as a convenience only and the Government assumes no liability whatsoever for

*MIL-I -46838B (MI)

any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the last previous issue.

Custodian:
Army-MI

Preparing activity:
Army-MI

Review activities:
Army-AR
DSA-GS

Project No. 5970-A533

User activity:
Army-ME

