

MIL-I-85491(AS)

6 October 1981

MILITARY SPECIFICATION  
INSULATION MATERIAL, POLYISOPRENE

This specification is approved for use by the Naval Air Systems Command, Department of the Navy, and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE.

1.1 Scope. This specification establishes the requirements for three types of non-asbestos-containing polyisoprene insulation material in the uncured calendered state (see 6.3.1).

1.2 Classification (see 6.2.1). Insulation covered by this specification shall be classified as follows:

|           |                           |
|-----------|---------------------------|
| Type I:   | 0.030-inch thick material |
| Type II:  | 0.050-inch thick material |
| Type III: | 0.100-inch thick material |

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

|         |   |
|---------|---|
| L-P-378 | Plastic Sheet and Strip, Thin Gage, Polyolefin. |
|---------|---|

STANDARDS

FEDERAL

|                                |                               |
|--------------------------------|-------------------------------|
| Fed Test Method<br>Std No. 601 | Rubber: Sampling and Testing. |
|--------------------------------|-------------------------------|

MILITARY

|             |                                   |
|-------------|-----------------------------------|
| MIL-STD-129 | Marking for Shipment and Storage. |
|-------------|-----------------------------------|

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commanding Officer, Naval Air Engineering Center, Engineering Specifications and Standards Department (ESSD), Code 93, Lakehurst, NJ 08733, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

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(Copies of specifications, standards, drawings, and publications required by suppliers in connection with specified procurement function should be obtained from the procuring activity or as directed by the contracting officer.)

2.2 Other publications. The following document forms 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.

#### STANDARDS

##### American Society for Testing and Materials (ASTM)

ASTM D 412

Standard Methods of Tension Testing of Rubber

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.)

#### 3. REQUIREMENTS.

3.1 Character or quality. The material shall be an uncured, non-asbestos-filled, polyisoprene material.

##### 3.2 Product characteristics.

3.2.1 Dimensions and tolerances. Thickness tolerances for each type of uncured, calendared sheet shall be within  $\pm 10$  percent of the specified thickness. Thickness tolerances within 1.50 inches of each edge of the roll and within 2 yards of each end of the roll shall not apply. The first and last 2 yards and 1.50 inch edges of each roll shall not be used in motor manufacture unless it complies with the thickness requirement. Width tolerances for each type of uncured, calendared sheet shall be within  $\pm 2$  percent of the specified width.

3.2.2 Release agent. The insulation material, during processing and packaging, shall be kept free from any type of release agent, except that a commercially available, color contrasted polyethylene film conforming to L-P-378, Type I, Class 1, Grade C, Finish 1, (0.003 inch thick) with a smooth surface (not embossed) shall be used to separate layers in the roll of the calendared insulation material.

3.2.3 Defects. The cumulative area of unvulcanized calendared insulation material in any roll containing defects such as wrinkles, voids, delaminations, and nonhomogeneous material, shall be not more than 10 percent of the area of the material in the roll.

NOTE: The area within 1.50 inches of each edge of the roll and within 2 yards of each end of the roll shall be excluded.

When determining percentage of defective area in the roll, any defects within 24 inches of each other, measured parallel to the edge of the roll, shall be considered as one continuous defect. Defective areas shall not be used in motor manufacture.

TABLE I. Chemical properties of unvulcanized material.

| Property  | Min  | Max  |
|---|------|------|
| Volatile content, percent                                     | ---  | 3.3  |
| Ash content, percent  | 24.2 | 26.8 |
| Flow index, inches<br>@ 4,000 pounds per<br>square inch (psi) | 3.2  | ---  |
| @ 2,500 psi   | 2.2  | ---  |

3.3.2 Mechanical properties. When vulcanized in accordance with 4.2.1 and tested at  $25 \pm 3$  degrees Celsius ( $^{\circ}\text{C}$ ), the insulation material shall conform to Table II.

3.4 Stability. When stored in accordance with Section 5, the insulation material shall have a shelf life of not less than 6 months from date of calendaring. The shelf life may be extended for 6-month intervals after reacceptance testing for conformance to the flow index requirements of Table I. Unless otherwise specified in the contract or purchase order, no insulation material will be accepted by the procuring activity with less than 5 months shelf life remaining.

3.5 Workmanship. The insulation material shall be uniform, clean, of consistent high quality, and free from defects to the extent specified in 3.2.3.

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TABLE II. Mechanical properties of vulcanized material.

| Property  | Min   | Max  |
|---|-------|------|
| Specific gravity, 25/4°C                        | 1.14  | 1.18 |
| Hardness, Shore A                               | 69    | 96   |
| Tensile strength, with grain (see 6.3.2), psi   | 1,000 | ---  |
| Tensile strength, across grain (see 6.3.3), psi | 820   | ---  |
| Tensile strength ratio (see 6.3.4)              | 0.8   | 1.7  |
| Ultimate elongation, across grain, percent      | 250   | ---  |

#### 4. QUALITY ASSURANCE PROVISIONS.

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order (see 6.2.1), the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, 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 this specification where such inspections are deemed necessary to assure that supplies and services conform to prescribed requirements.

4.2 Sampling. Selection of samples shall be in accordance with random sampling methods as specified in the Sampling and Acceptance Procedures section of Fed Test Method Std No. 601. Samples shall be taken from each lot of material, packaged, and identified as follows:

- a. Beginning not less than 2 yards from the end of roll, remove sufficient material for tests on samples as specified in 4.4. Indicate direction of the grain on the sample.
- b. Wrap the samples in a clean waterproof wrapper that will provide protection from moisture and light.
- c. Prepare an identification label with the following information and attach it to the wrapper:
  1. Number and revision letter of this specification.
  2. Material name or identification designation.
  3. Lot number.
  4. Date and time sample taken.
  5. Identity of sample taken.

4.2.1 Vulcanized samples. For tests requiring vulcanized specimens, the samples shall be vulcanized at a pressure of  $100 \pm 10$  pound-force per square inch gage for 2.0 to 2.5 hours at  $107 \pm 3^\circ\text{C}$ . Any deviation from these conditions shall require prior approval of the procuring activity.

4.3 Quality conformance inspections. Quality conformance tests and inspections shall consist of the following for each lot of insulation material (see 6.3.5):

- a. Tests of Table I and Table II properties (see 4.4).
- b. Visual inspection (see 4.5.2).
- c. Packaging (see Section 5).

4.3.1 Acceptance criteria. Failure of any sample to pass all the requirements specified herein shall cause rejection of the lot represented.

4.4 Test methods. Tests shall be performed using apparatus, reagents, and procedures specified herein. The use of alternate apparatus, reagents, or procedures shall require prior written approval of the procuring activity.

4.4.1 Volatile content. Weigh duplicate specimens of from 10 to 15 grams (gm) to the nearest 0.001 gm. Place the specimens in a vacuum oven at  $107 \pm 3^\circ\text{C}$  with absolute pressure not greater than 75 millimeters of mercury. The specimens shall remain in the oven for not less than 4 hours. Remove, reweigh, and calculate the volatile content.

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Calculation:

$$\text{Percent volatile} = \frac{(B - A) \times 100}{B}$$

Where: A = weight of specimen after heating, gm

B = weight of specimen prior to heating, gm

Report the average of the duplicate specimens to the nearest 0.1 percent.

4.4.2 Ash content. Weigh duplicate specimens of from 6 to 8 gm to the nearest 0.001 gm. Place the specimens in a muffle furnace at 815 ±28°C for not less than 60 minutes. Remove, reweigh and calculate the ash content.

Calculation:

$$\text{Percent ash} = \frac{A \times 100}{B}$$

Where: A = weight of specimen after heating, gm

B = weight of specimen prior to heating, gm

Report the average of the duplicate specimens to the nearest 0.1 percent.

4.4.3 Flow index.

4.4.3.1 Apparatus. Garlock Flow Index Machine, or equal, with a 0.25-inch diameter orifice sprue.

4.4.3.2 Flow index measurements. Prepare duplicate specimens of the calendered insulation material to a diameter of approximately 1.12 inches and a thickness of approximately 0.50 inch. One specimen shall be tested at 4,000 psi and one tested at 2,500 psi. Place the specimen in the pressure chamber of the flow index machine and test at applicable pressure for 3 minutes ±15 seconds at 149 ±6°C. Each of the four legs of the tested specimen shall be measured to the nearest 0.05 inch. The test shall be repeated if the four readings on a single specimen do not agree within 10 percent. Report the average value of the four readings on each specimen to the nearest 0.05 inch.

4.4.4 Specific gravity. Specific gravity shall be determined in accordance with Fed Test Method Std No. 601, Method 14011. The average specific gravity at 25/4°C shall be reported to the nearest 0.01.

4.4.5 Hardness. Hardness shall be determined in accordance with Fed Test Method Std No. 601, Method 3021.

4.4.6 Tensile strength. Tensile strength shall be determined in accordance with Fed Test Method Std No. 601, Method 4111, die Type III, with the exception that the average of values obtained shall be reported to the nearest 10 psi, and that two types of specimens shall be prepared from the calendered samples. One type shall be such that the material grain direction is oriented in the length direction of the specimen for with-grain testing. The other type shall be such that the material grain direction is oriented in the width direction of the specimen for across grain testing.

4.4.7 Ultimate elongation. Using the same specimen that was used in determining across grain tensile strength (see 4.4.6), ultimate elongation shall be determined in accordance with ASTM D 412, Method A, Die C, except that the test temperature shall be  $25 \pm 3^\circ\text{C}$ , and the average shall be reported to the nearest 10 percent. The elongation shall be measured by an electrical extensometer with provisions for indicating 10 percent strain increments on the load versus crosshead displacement chart.

#### 4.5 Examinations.

4.5.1 Dimensional inspection. The dimensions of the unvulcanized calendered insulation material shall be determined at a material temperature of  $25 \pm 3^\circ\text{C}$ . The thickness shall be determined by a micrometer or comparator graduated to 0.001 inch having an anvil or pressure foot of 0.375-inch diameter and exerting a total force of  $3.0 \pm 1.0$  ounces.

4.5.2 Visual inspection. Visual inspection shall be made to determine conformance to the requirements of 3.2.3, 3.5, and the packaging and marking requirements herein.

4.6 Records. Certification and test data shall be prepared as required by the procuring activity (see 6.2.2).

#### 5. PACKAGING.

##### 5.1 Preservation-packaging.

5.1.1 Level C (see 6.3.7). The insulation material shall be rolled on a spool with a separator as specified in 3.2.2. The inside diameter of the roll shall be not less than 3 inches. The roll shall be packaged so that it does not become contaminated during shipping and handling. While in the shipping container, the roll shall be supported at each end of the spool to prevent the roll from becoming distorted. The maximum weight of the roll (including separator and spool) shall be 200 pounds.

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### 5.2 Packing.

5.2.1 Level C. Insulation material, packaged in accordance with 5.1.1, shall be packed in a closed container to prevent contamination and damage. Packing shall be in accordance with commercial practice to ensure carrier acceptance and safe transportation.

### 5.3 Marking.

5.3.1 Roll marking. Unless otherwise specified herein, each roll shall have a tag attached to it showing the supplier's lot number, roll number, and date of cure-agent addition.

5.3.2 Container marking. In addition to any special marking required by the contract or purchase order (see 6.2.1), unit packages and shipping containers shall be marked in accordance with the requirements of MIL-STD-129. Container marking shall include the following:

- a. The supplier's lot number and roll number.
- b. Procuring activity purchase order number.
- c. Date of packing, date of cure-agent addition and date of calendaring.
- d. Precautionary marking as follows:

#### CAUTION

SHIP AND STORE AT TEMPERATURES BELOW 16°C (60° Fahrenheit)

5.4 Storage and shipment. The insulation material shall be protected from contamination and direct sunlight at all times. Storage and shipment of the insulation material shall be at a temperature below 16°C. The material shall be sealed in water, vapor-resistant containers. Caution shall be exercised to prevent contamination to unpackaged (not enclosed in waterproof liner) insulation material upon removal from storage temperature below 4°C.

## 6. NOTES AND CONCLUDING MATERIAL.

6.1 Intended use. The insulation material described herein is intended to be used as insulation in rocket motor cases.

### 6.2 Ordering data.

6.2.1 Procurement requirements. Procurement documents should specify the following:

- a. Title, number and date of this specification.
- b. Thickness of material required (see 1.2).
- c. Responsibility for inspection and inspection facilities if different than 4.1.
- d. Width and thickness dimensions of calendered sheet.
- e. Special marking requirements, if required (see 5.3.2).

6.2.2 Data requirements. When this specification is used in a procurement which incorporates a Contracts Data Requirements List (DD Form 1423) and invokes the provisions of 7-104.9(n) of the Defense Acquisition Regulations (DAR), the data requirements identified below will be developed as specified by an approved Data Item Description (DID) (DD Form 1426) and delivered in accordance with the approved DD Form 1423 incorporated into the contract. When the provisions of DAR-7-104.9(n) are not invoked, the data specified below will be delivered by the contractor in accordance with the contract requirements. Deliverable data required by this specification is cited in the following paragraphs:

| <u>Paragraph</u> | <u>Data Requirement</u>    | <u>Applicable DID</u>     |
|------------------|----------------------------|---------------------------|
| 4.6              | Certification<br>Test Data | UDI-A-23264E<br>DI-T-4024 |

(Copies of DIDs required by the contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

### 6.3 Definitions.

6.3.1 Calender. Calender, as used herein, is defined as the process by which the material from a single batch is rolled or processed into sheets to the required final width and thickness.

6.3.2 With grain. With grain, as used herein, is defined as the direction of rolling or calendering of the insulation material.

6.3.3 Across grain. Across grain, as used herein, is defined as perpendicular to the direction of rolling or calendering of the insulation material.

6.3.4 Tensile strength ratio. Tensile strength ratio, as used herein, is the tensile strength with grain divided by the tensile strength across grain direction.

6.3.5 Lot. Lot, as used herein, consists of that quantity of material processed in a single batch (see 6.3.6), and which is calendered in one continuous work period, and of one thickness.

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6.3.6 Batch. Batch, as used herein, consists of that quantity of material produced in one operation when all ingredients are combined, but before calendaring into finished sheets. More than one lot may be made from a single batch.

6.3.7 Level C. For definition of levels of packaging and packing, refer to FED-STD-102.

6.4 Suggested source of supply. A product that has met the requirements of this specification in past procurement actions is Rubber Insulation 44765, manufactured by Uniroyal Plastics Products, Code Ident 00333. This information is for the convenience of the procuring activity and is not to be construed as a waiver of any requirement of this specification nor as any limitation of additional potential sources of supply.

Preparing activity:  
Navy - AS

(Project 6810-NB20)

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