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MILITARY SPECIFICATION

INSULATION, SYNTHETIC, RUBBER-LIKE, CHEMICALLY EXPANDED, CELLULAR, (SHEET FORM)

This specification has been approved by the Naval Ordnance Systems Command, Department of the Navy.

1. SCOPE

1.1 This specification covers chemically expanded synthetic rubber-like material (sheet form) for insulation purposes. (See 6.1.)

2. APPLICABLE DOCUMENTS

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

SPECIFICATIONS

Federal

C-C-91	Candle, Illuminating
PPP-B-576	Box, Wood, Cleated, Veneer, Paper Overlaid
PPP-B-591	Box, Fiberboard, Wood-Cleated
PPP-B-601	Box, Wood, Cleated-Plywood
PPP-B-621	Box, Wood, Nailed and Lock-Corner
PPP-B-636	Box, Fiberboard

Military

MIL-S-901	Shock Tests, High Impact (H.I.) Shipboard Machinery, Equipment, and Systems, Requirements for

STANDARDS

Federal

FED-STD-601	Rubber: Sampling and Testing

Military

MIL-STD-129	Marking for Shipment and Storage

(Copies of specifications, standards, drawings, and publications required by suppliers 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 and Materials

ASTM C 177	Thermal Conductivity of Materials by Means of the Guarded Hot Plate, Test for

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

3. REQUIREMENTS

3.1 First article. A first article of insulation material to be furnished under this specification shall be produced prior to the manufacture of this item in production quantity. The first article shall be submitted to the activity designated in the contract or purchase order for first article inspection to determine conformance to the requirements of this specification. The first article submitted by a contractor shall be fully representative of the insulation material to be supplied from production facilities and tooling.

3.2 Material. The chemically expanded cellular, elastomeric material furnished under this specification shall consist of a foam-like structure having multitudinous closed hollow cells of nearly uniform size, held together but sealed off from one another by the matrix of elastomeric material. The material shall be homogeneous throughout, free from large voids, foreign inclusions, contaminants or seams, and shall be free from any material that accelerates aging and deterioration, or contributes to the formation of toxic gases in harmful concentrations. The material shall not give off a noxious odor. All material shall be in accordance with good commercial practice.

3.3 Color. Unless otherwise specified, the color of the insulating material shall be optional with the manufacturer.

3.4 Cement. The cement supplied for use in installing the insulating material (see 3.1) shall be suitable both for cementing the insulating material to other parts of the same material as well as cementing the insulating material for the metal structure in a permanent bond that meets the further requirements of this specification. The cement shall be free from any material that accelerates aging and deterioration of the insulating material and shall not contain any material that corrodes the metal surface to which it is applied. The cement shall not contribute a noxious odor or toxic gases in harmful concentration under all conditions of handling, storage, and application. The cement, when used at the seams, when dry, shall have the same resiliency as the insulating material. It shall not cause swelling or shrinking of the insulating material when applied to it.

3.5 Physical requirements. The insulating material shall conform to the physical requirements of table I.

3.6 Postforming stabilization. Subsequent to forming, the insulating material shall be allowed to stand a sufficient length of time for the sheets to become dimensionally stable, so that no subsequent shrinkage will occur after the sheet material has been cut to size.

3.7 Other requirements. The insulating material shall be suitable for cementing to the inside of metal structures and for cementing joints between various pieces of the same material for insulating purposes. The material shall be tough and resistant to tearing. It shall not be adversely affected by continued exposure to any environmental temperature between -20° Fahrenheit (F) and 160° F or by shipboard vibration

and shock, within the limits specified in table I. The material shall not contribute to the formation of toxic gases in harmful concentration during storage, installation, or in service. The material, when burning, shall be no more toxic than the majority of similar materials. The insulating material shall be suitable for application of sprayed coatings of adhering plastic film (aluminum pigment), after being cemented into place.

Table I

PHYSICAL REQUIREMENTS

Test	Condition	Ref. para.	Requirement
Density	Std atm 80° ± 9° F	4.3.2	7 lb cu ft maximum
Compression deflection	Std atm 80° ± 9° F	4.3.3	25% compression at 2 ± 1/2 psi
Water absorption	22 ± 1/4 hr at 73.4° ± 3.6° F	4.3.4	0.1% maximum
Oil immersion	70 ± 1/4 hr at 212° ± 3.6° F	4.3.5	No swelling or softening
Accelerated heat aging	7 days at 140° ± 2° F	4.3.6	±5% max volume change
Accelerated cold aging	7 days at -20° ± 2° F	4.3.7	±5% max volume change
Brittleness	180° bend over mandrel while soaked at -50° F	4.3.8	No cracks after test
Fire resistance			
Burning time	70° ± 5° F ambient	4.3.9.1	2 sec maximum
Char length	70° ± 5° F ambient	4.3.9.2	1 inch maximum
Char temperature	-	4.3.9.2	400° F minimum
Melting temperature	-	4.3.9.2	800° F minimum
Ignition temperature	-	4.3.9.2	1000° F minimum

Table I (contd)

Test	Condition	Ref. para.	Requirement
Burning time (oil immersed)	Immersed in oil 24 hr at 70° ± 5° F; cleaned with petroleum ether; dried 2 hr in free air	4.3.9.3	5 sec maximum
Insulation toxicity	-20° F to burning temp	4.3.10	Nontoxic
Cement toxicity	During installation or when burning	4.3.10	Nontoxic during installation; relatively nontoxic when burning
Adhesion tests			
Insulation material to metal and insulation material to itself	Heat, cold, shock, or vibration	4.3.11, 4.3.13 through 4.3.16	No appreciable weakening of bond
Wick climb	70° ± 5° F with one end in oil	4.3.12	1/4 inch maximum
Shock test (hot)	Cemented to steel plate, soaked at 160° F - 6 hours, 2000 foot-pounds - 4 blows (see figure 1)	4.3.13	No change
Shock test (cold)	Cemented to steel plate, soaked at -20° F - 6 hours, 2000 foot-pounds - 4 blows (see figure 2)	4.3.14	No change
Vibration test (hot)	1/16-inch total amplitude (in 3 directions) varying 900 - 1600 cycles per minute (see figure 1)	4.3.15	No change

Table I (contd)

Test	Condition	Ref. para.	Requirement
Vibration test (cold)	1/16-inch amplitude (in 3 directions) varying 900 - 1600 cycles per minute (see figure 2)	4.3.16	No change
Difference in temperature (hot)	1-inch-thick sheet cemented to steel plate, 160° F for 6 hours (see figure 1)	-	50° - 5° F
Difference in temperature (cold)	1-inch-thick sheet cemented to steel plate, -20° F for 6 hours (see figure 2)	-	50° - 5° F
Tensile tests			
Strength	70° ± 5° F	4.3.17	20 psi (average)
Strength of cemented joint	70° ± 5° F	4.3.18	20 psi (avarage)
K-factor	-20° to 160° F	4.3.19	0.40 maximum
Odor	-20° to 160° F	-	No persistent bad odor

3.8 Workmanship. All materials and workmanship shall be in accordance with good commercial practice in the manufacture of cellular rubbers. The material shall be free from defects which may affect serviceability.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements, as specified herein. Except as

otherwise specified in the contract or order, the supplier may use his own or any other facilities suitable for 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 supplies and services conform to prescribed requirements.

4.1.1 Sampling.

4.1.1.1 Lot. Unless otherwise specified, a lot shall consist of all insulating material of the same composition and the same grade submitted for inspection at the same time.

4.1.2 Sampling procedure. Samples shall be selected in accordance with the following.

4.1.2.1 Finished product. When possible, a sheet of the finished product as furnished by the manufacturer, shall be used for the tests specified to determine compliance with the requirements of this specification. Representative samples of the lot being examined shall be selected by the inspector as required.

4.1.2.2 Standard test specimens. Standard test specimens shall be as listed in table II.

Table II

STANDARD TEST SPECIMENS

Number	Size (in.)	Test
2	See 4.3.3.1	Compression deflection
3	1 by 3 by 4	Density
2	See 4.3.4.1	Water absorption
3	See 4.3.5.1	Oil immersion
6	1 by 1 by 3	Aging (hot and cold)
4	1/4 by 1/4 by 3	Brittleness
4	1/4 by 1 by 4	Fire resistance
4	1/2-inch cubes	Burning
1	1 by 18 by 18	Adhesion
4	1 by 1/4 by 2	Wick climb
3	1 by 18 by 18	Insulation, shock, and vibration characteristics
6	See figure 3	Tensile strength

4.1.2.3 Preparation of standard test specimens. All samples for a given lot shall be cut from the same sheet of material, where possible. Samples shall have parallel cut edges with smooth surfaces and free from tears. All measurements shall be made as specified in 4.2.3.

4.2 Inspection.

4.2.1 Place of inspection. Unless otherwise specified, the inspection shall be made at the place of delivery.

4.2.2 Visual inspection. All samples selected for testing shall be visually inspected to assure that the material is free from holes, dirt, foreign matter, and color variations which may indicate different physical properties within a single sheet. The sample sheet shall be free from rips, tears, or abraded portions of the surface.

4.2.3 Dimensions.

4.2.3.1 Length. The specimen length shall be determined in accordance with method 12011 of FED-STD-601.

4.2.3.2 Width. Specimen width shall be determined in accordance with method 12021 of FED-STD-601.

4.2.3.3 Thickness. Specimen thickness shall be determined in accordance with method 12031 of FED-STD-601.

4.2.3.4 Diameters. The specimen diameter shall be determined in accordance with method 12041 of FED-STD-601.

4.3 Tests. Samples taken as specified in 4.1.2 shall be tested as follows.

4.3.1 Test specimens shall be cut from the finished sheet of insulation material. The inspector shall select the sheet or sheets from material having stabilized dimensions after the forming operation (see 3.6).

4.3.2 Apparent density. The apparent density determination shall be made as follows.

4.3.2.1 Apparent density test specimens. The test specimens shall be 1 by 3 by 4 inches.

4.3.2.2 Apparatus. The apparatus shall consist of a suitable weighing device accurate to within 0.25 percent.

4.3.2.3 Procedure. The volume of the test specimen shall be calculated from measurements of length, width, and thickness. The weight shall be determined. The apparent density shall be calculated by dividing the weight in ounces by the volume in cubic inches and the result recorded. A minimum of three tests shall be made and the results averaged. The average value shall be reported in terms of pounds per cubic foot.

4.3.3 Compression deflection.

4.3.3.1 Test specimens. Specimens for this test shall be as listed in method 12141 of FED-STD-601.

4.3.3.2 Procedure. The specimens shall be tested as specified in method 12151 of FED-STD-601. The specimen shall be compressed 25 percent of its original thickness at a force of 2 ± 1/2 pounds per square inch.

4.3.4 Water absorption.

4.3.4.1 Test specimens. Specimens for this test shall be as listed in method 12141 of FED-STD-601.

4.3.4.2 Procedure. The specimens shall be tested as specified in method 12411 of FED-STD-601. The percentage change in volume shall not exceed 0.1 percent.

4.3.5 Oil immersion.

4.3.5.1 Test specimens. Specimens shall be as listed in method 12141 of FED-STD-601.

4.3.5.2 Procedure. The specimens shall be tested as specified in method 12311 of FED-STD-601.

4.3.5.3 Calculation. The percentage change in volume shall be calculated as follows:

For volume increase:

$$\text{Volume change, percent} = \frac{V_2 - V_1}{V_1} \times 100$$

For volume decrease:

$$\text{Volume change, percent} = \frac{V_1 - V_2}{V_1} \times 100.$$

Where

V_1 = original volume, and
V_2 = volume after immersion.

4.3.6 Accelerated heat aging.

4.3.6.1 Test specimens. Specimens shall be as listed in table II. Not less than three specimens from each lot shall be tested.

4.3.6.2 Apparatus. The apparatus shall consist of an automatic temperature controlled oven which has a minimum interior size of 18 by 18 by 18 inches, or equivalent volume. The oven shall be provided with a means of air circulation and shall be properly baffled for even heat distribution. The heat source shall be air, externally heated. The oven shall provide a controlled temperature of 140° ± 2° F. The oven shall provide a means for mounting the test specimens in the vertical position in such a way that they do not touch each other or the sides of the oven. A thermometer shall be located so as to indicate the temperature of the upper central portion of the oven.

4.3.6.3 Procedure. The test specimens shall be positioned in a preheated, stabilized oven. The specimens shall remain in the oven for a period of 7 days. At the end of the 7-day period, the specimens shall be removed from the oven, placed on a flat surface and allowed to cool. The samples shall not be tested within 16 hours after their removal, but

shall be tested within 48 hours. The volume change shall be determined as specified in 4.3.5.3 (see table I).

4.3.7 Accelerated cold aging.

4.3.7.1 The specimens shall be as listed in table II. Not less than three specimens shall be tested from each lot.

4.3.7.2 Apparatus. The test apparatus shall be a chamber at least 18 by 18 by 18 inches, or of equivalent volume, equipped with an automatic temperature control capable of maintaining the chamber at -20° ± 2° F. It shall be properly baffled to maintain uniformity when supplied with cold air from a source exterior to the chamber. The chamber shall provide a means for vertical suspension of the specimens, separate from each other and not contacting the interior walls or surfaces of the chamber. A thermometer shall be provided to indicate the temperature of the lower central portion of the chamber adjacent to the suspended specimens.

4.3.7.3 Procedure. The test specimens shall be positioned in the precooled and stabilized chamber at a temperature of -20° ± 2° F and shall remain in the chamber at this temperature for 7 days. At the end of the 7-day soak, the specimens shall be removed from the chamber, placed on a flat surface, and allowed to warm to room temperature. The specimens shall not be tested within 16 hours of their removal from the chamber, but shall be tested within 48 hours. The change of volume shall be measured and calculated as specified in 4.3.5.3 (see table I).

4.3.8 Brittleness.

4.3.8.1 Test specimens. The test specimen for the cold embrittlement test shall be as specified in table II. Not less than four samples from each lot shall be tested.

4.3.8.2 Apparatus. The test chamber shall be automatically temperature controlled to maintain the interior at any selected value down to and including -65° F. The chamber shall be provided with forced air circulation which insures temperature variation of no more than 3° F within the enclosure, at any chosen temperature setting. The source for the cooling of the circulating air shall be externally located. The dimensions of the chamber shall be large enough to accomodate the samples and supports (see 4.3.7.3) and to allow the necessary manipulation without interference. The chamber shall be provided with ports which permit

insertion of the test technician's hand during that portion of the test requiring bending of the specimens. A hook-shaped glass rod shall be provided for specimen manipulation.

4.3.8.3 Procedure. Each of the test samples shall be clamped between two glass rods, approximately five-sixteenths inch in diameter, in such a manner that two-thirds of the length of the specimen extends vertically above the rods. Each glass rod specimen assembly shall be supported in a horizontal position in the central region of the chamber between two commercial laboratory test stands by means of suitable clamps. The specimens shall be placed in the chamber at room temperature. The temperature shall be gradually lowered to 0° ± 5° F and held at this temperature for 15 minutes. Each specimen shall then be given a quick bend by pulling it with the hooked tool so as to produce an 180° bend over one of the clamping rods. This procedure shall be repeated in increments of 5° F as the chamber temperature is lowered. When the temperature is reached at which the first specimen breaks when quickly bent 180°, the next specimen shall be slowly bent. This procedure shall be continued until all the specimens break when bent slowly. The average temperature at which the last three specimens break shall be reported as the brittle temperature. The average value shall meet or exceed the requirements of 3.5 (table I).

4.3.9 Fire resistance.

4.3.9.1 Burning time.

4.3.9.1.1 Test specimens. The specimens for this test shall be as given in table II.

4.3.9.1.2 Procedure. The specimens shall be clamped at one end in such a position that the long dimension forms a 45° angle with the horizontal and with the 1-inch width in a vertical position. A candle flame shall be applied to the lower free end of the specimen for 15 seconds. The candle shall then be removed and the time that the specimen continues to burn shall be recorded as flame duration time. The length of char shall also be recorded. The test shall be performed in a draft-free environment. The candle shall conform to C-C-91, class B.

4.3.9.2 Char length and temperature, melting temperature, and ignition temperature.

4.3.9.2.1 Test specimens. The test specimens shall be as given in table II.

4.3.9.2.2 Apparatus. An electrically heated furnace, automatically controlled, with a range in excess of 1500° F shall be used for these tests. The furnace shall provide uniformity to within 10° F. The interior dimensions of the furnace shall be 4 by 4 by 10 inches. Sample supports shall be provided so that the samples do not contact each other or the walls of the furnace during tests. A pyrometer shall be provided, located in the upper central region adjacent to the specimens.

4.3.9.2.3 Procedure. The specimens shall be placed in the furnace which has been preheated to 160° F and held at this temperature for 1 hour. The temperature of the furnace shall then be raised at the rate of approximately 10° F per minute and observations made at each 10° F rise. The temperature at which the specimens begin to char shall be recorded. If melting occurs, the temperature of inception of melting shall be recorded, as well as the temperature at which melting is completed. The temperature at which the specimens ignite shall be recorded, as well as the temperature at which burning is completed. The condition of the specimens after burning shall also be recorded. The material shall meet the requirements of 3.5 (table I).

4.3.9.3 Burning time, oil immersed specimens.

4.3.9.3.1 Test specimens. The test specimens shall be as listed in table II.

4.3.9.3.2 Procedure. Two specimens shall be immersed for 24 hours in lubricating oil conforming to MIL-L-19224 and two specimens shall be immersed 24 hours in transmission fluid conforming to MIL-F-17111. The specimens shall be removed from the test liquids, dipped into petroleum ether at room temperature, blotted lightly with filter paper and allowed to remain exposed at room atmosphere for 2 hours. The fire resistance test of 4.3.9.1.2 shall be repeated, and the burning time and length of char shall be recorded. The material shall meet the requirements of 3.5.

4.3.10 Toxicity of insulating material and cement.

4.3.10.1 Independent testing laboratory report. The test specimens and a representative sample of cement to be used in application of the insulating material shall be accomplished by a certified report from an accredited testing laboratory, stating that the basic materials and the expanding or blowing agent as well as the constituents of the cement will not produce unduly toxic fumes in harmful concentration during the process of installation, under normal storage, or when burning.

4.3.11 Adhesion; insulation material cemented to metal and insulation material cemented to insulation material.

4.3.11.1 Test specimen. The test specimen shall be as specified in table II.

4.3.11.2 Procedure. A 9- by 9-inch square shall be cut from the 18-inch-square test specimen; both pieces shall be cemented to an 18- by 18- by 1/4-inch steel plate. The 9- by 9-inch piece shall be cemented to the piece from which it was cut to re-form the 18- by 18-inch square and to provide the cemented joint of insulating material to insulating material. Application of the cement shall be in accordance with manufacturer's instructions. The specimen shall be visually examined after the recommended drying period. The cemented seam between the pieces of insulating material shall be straight and undistorted; there shall be no evidence of shrinkage or voids. There shall be no swelling or softening of the material due to the application of the cement. There shall be no evidence of corrosion or chemical attack of the steel by the cement.

4.3.12 Wick climb.

4.3.12.1 Test specimens. Test specimens shall be as listed in table II.

4.3.12.2 Procedure. Two specimens shall be positioned vertically in a beaker previously filled with lubricating oil conforming to MIL-L-19224. The ends of the specimens shall be in contact with the bottom of the beaker to a depth of one-fourth inch. The specimens shall not touch the sides of the beaker or move during the test. The specimens shall be observed after standing 24 hours at approximately 70° F. The average distance the oil has climbed the specimen surface above the level of oil in the beaker shall be recorded. Two additional specimens shall be similarly tested in transmission fluid conforming to MIL-F-17111 and the wick climb recorded. The insulating material shall meet the requirements of 3.5 (table I).

4.3.13 Shock test (hot).

4.3.13.1 Test specimen. The test specimen shall be a specimen which has passed the adhesion tests of 4.3.11.

4.3.13.2 Apparatus. The apparatus shall be a box constructed as shown in figure 1. Provisions shall be made for maintaining a constant temperature of 160° ± 2° F in the lower region of the box, utilizing a

calrod electric heater coil. A reflector plate shall be located one-half inch below the calrod heater. The steel plate with the insulating material cemented thereto shall be mounted with the insulating material up and with the steel plate on the underside 3-1/2 inches above the calrod heater. A thermocouple shall be located midway between the steel plate and the calrod heater. This thermocouple registers the temperature of the air in the bottom compartment. This temperature is recorded on a Brown Instrument Company recorder, or equivalent. The specimen shall be 4 inches below the top of the box. Additional thermocouples, one to each quarter section, shall be located immediately beneath the skin of the insulation material. These temperatures are also recorded, and the average of these values is recorded as the skin temperature during the test. The shock test machine shall be a standard 2000-pound, class HI, MIL-S-901, shock test machine as shown in figure 1 of MIL-S-901.

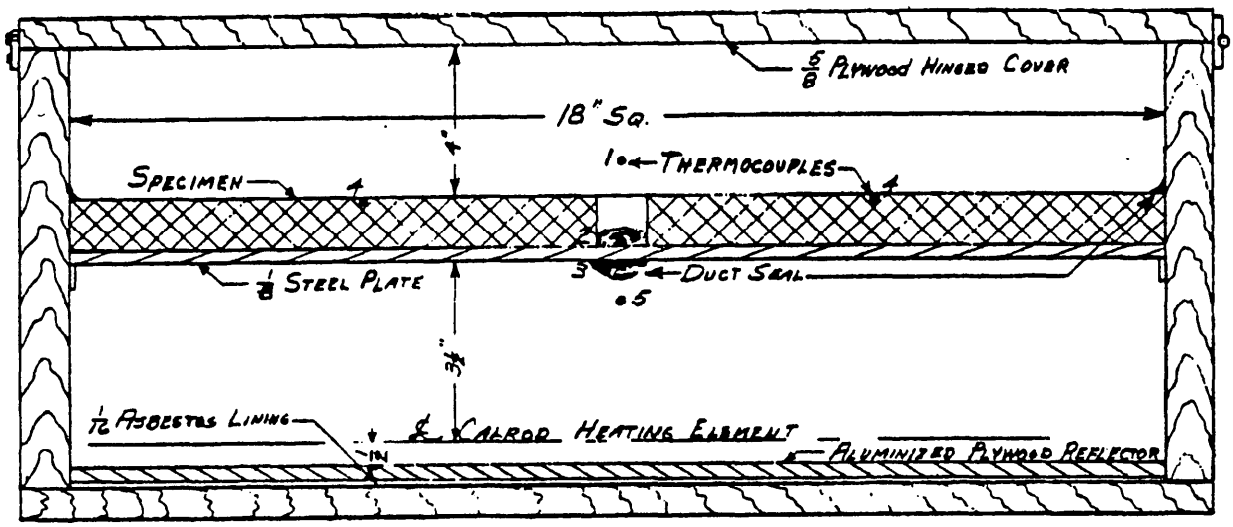

FIGURE 1. HOT TEMPERATURE TEST BOX

4.3.13.3 Procedure. The test specimen shall be placed in a test box, the thermocouples connected to the recorder, and the temperature gradually raised to 160° ± 5° F. The temperature shall be held at 160° ± 5° F for 6 hours. At the end of the 6-hour heat soak, the specimen shall be removed from the box, placed on the shock test machine and given four 2000-pound blows. Not more than 60 seconds shall elapse from the time the specimen is removed from the box to the completion of the shock test. The specimen shall be examined and there shall be no evidence of the insulating material tearing away from the steel plate nor any tearing away or opening at the seams. There shall be no evidence of softening or swelling of the cement or insulating material.

4.3.14 Shock test (cold).

4.3.14.1 Test specimen. The test specimen shall be the same specimen used in 4.3.13. No recementing will be allowed.

4.3.14.2 Apparatus. The apparatus shall be the same as that used in 4.3.13.2 except that the calrod heater is not used and the test specimen is inverted, so that the insulating material faces the bottom of the box. A perforated tray containing Dry Ice is situated above the test specimen as shown in figure 2. The quantities of Dry Ice are added or removed as necessary to maintain a temperature of -20° ± 5° F in the test box. Thermocouples shall be located in the box and on the specimen as shown in figure 2.

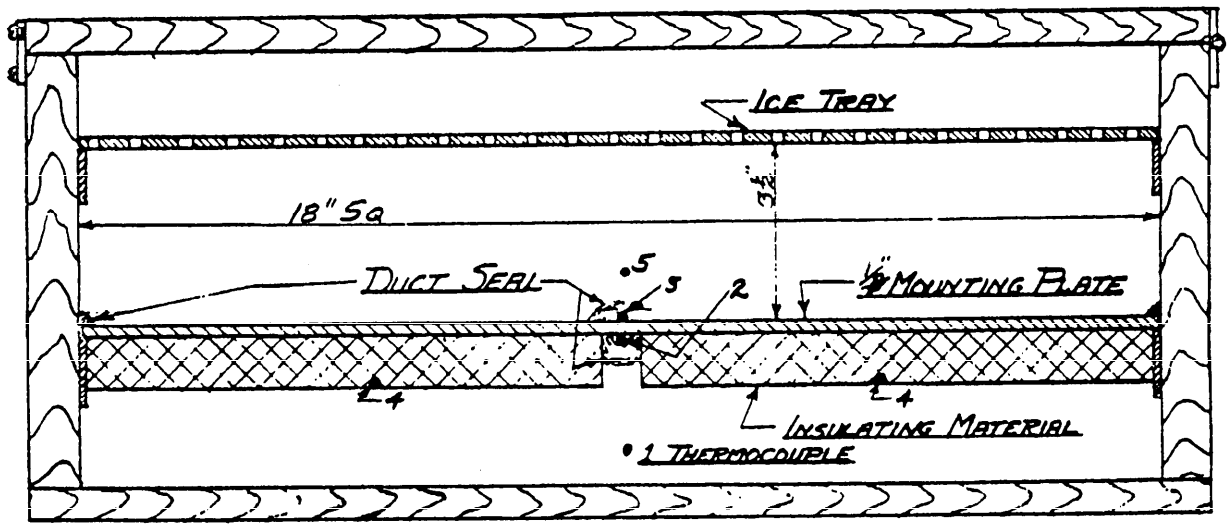

FIGURE 2. COLD TEMPERATURE TEST BOX

4.3.14.3 Procedure. The test specimen shall be placed as shown in figure 1, the thermocouples connected, and the perforated tray located 3-1/2 inches above the sample supplied with Dry Ice. The temperature shall be gradually lowered to -20° ± 5° F and held for 6 hours. The temperature shall be continuously recorded. At the end of the 6-hour cold soak, the specimen shall be removed from the box and given four 2000-pound blows on the shock machine. No more than 60 seconds shall elapse between the removal of the specimen and the time the shock test is completed. The specimen shall then be examined for evidence of hardening, breaking, or tearing away from the plate or at the seams (see 3.5, table I).

4.3.15 Vibration test (hot).

4.3.15.1 Test specimen. The specimen for this test shall be a specimen that has successfully passed the tests of 4.3.13 and 4.3.14.

4.3.15.2 Apparatus. The apparatus for this test shall consist of the same box used in 4.3.13 and 4.3.14, together with an adapting frame, and a standard vibration testing machine. The vibration testing machine shall be set for an amplitude of one-sixteenth inch in three directions and shall be cycled from 900 to 1600 cycles per minute. The thermocouples shall be located as specified in 4.3.13.

4.3.15.3 Procedure. The calrod heater, reflector plate, thermocouples, and test specimen shall be mounted in the box as specified for 4.3.13. The box shall be positioned on the mounting frame and secured to the vibration testing machine. The temperature shall be gradually increased to 160° ± 5° F and held for 6 hours. During this period the vibration machine shall be operated at an amplitude of one-sixteenth inch and varied from 900 to 1600 cycles per minute. At the end of the test, the specimen shall show no evidence of tearing, either away from the metal plate or at the seams. The insulating material shall show no evidence of softening or swelling. The cement shall shown no evidence of softening or failure.

4.3.16 Vibration test (cold).

4.3.16.1 Test specimen. The test specimen shall be a specimen which has successfully passed the tests of 4.3.13, 4.3.14, and 4.3.15. No recementing will be allowed.

4.3.16.2 Apparatus. The apparatus shall be the same as used in 4.3.15 except that the test specimen shall be mounted within the box and cooled as described in 4.3.14. The test box is used in the reverse position to allow manipulation of the Dry Ice used for cooling (see figure 2).

4.3.16.3 Procedure. The box containing the test specimen is positioned on the vibration testing machine, and the Dry Ice is placed in the perforated tray to cool the specimen as specified in 4.3.14. The temperature shall be lowered to -20° ± 5° F and held at this temperature for 6 hours. During the entire period the vibration machine shall be operating at an amplitude of one-sixteenth inch and a frequency of 900 to 1600 cycles per minute. The temperatures shall be continuously recorded.

At the end of the 6-hour test period, the specimen shall be removed from the test box. Any evidence of separation of insulating material from the plate or at the seams, tears in the insulation material, shrinkage of the insulation material, or cracking or flaking of the cement shall be cause for rejection.

4.3.17 Tensile test (strength).

4.3.17.1 Test specimens. The test specimens shall be die-cut to conform to figure 3. The constructed portion shall be one-fourth inch wide and 2 inches long. The enlarged ends shall be 1 inch wide and the thickness of the specimen shall be one-fourth inch.

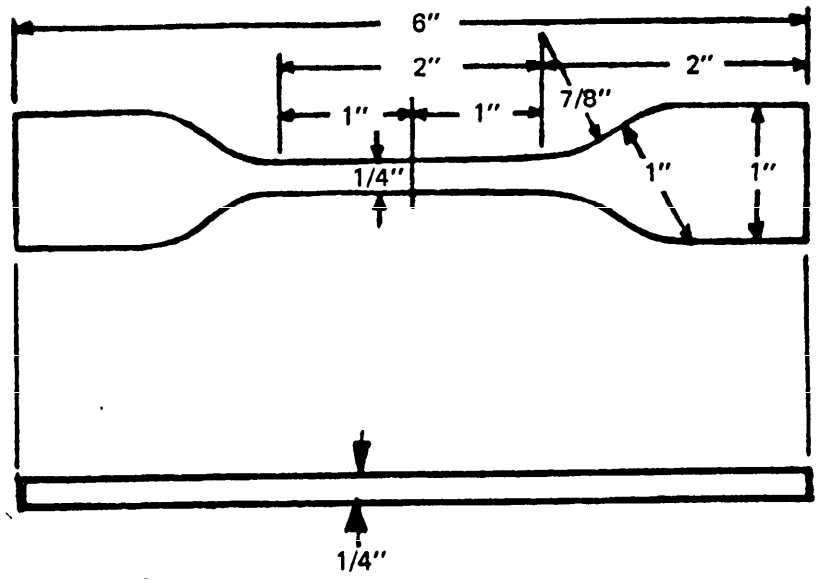

FIGURE 3. TENSILE TEST SPECIMEN

4.3.17.2 Procedure. A standard tensile testing machine shall be used. The rate of separation of the jaws holding the ends of the test specimen shall be 2 inches per minute. A minimum of four specimens shall be tested. Any specimen failing at the clamped portion shall be disregarded. Two specimens shall be taken from the center of the sheet of insulating material and two shall be taken from one side, keeping the surface skin intact. The tensile strength shall be calculated by dividing the breaking load in pounds by the original cross-sectional area of the specimen in square inches. The results shall be expressed as pounds per square inch. The average tensile strength of four specimens shall be recorded. The tensile strength shall meet the requirements of 3.5.

4.3.18 Tensile test of cemented joint.

4.3.18.1 Test specimens. The test specimens shall be die-cut as in 4.3.17. The specimens shall be cut in two at the center of the restricted portion. The cut shall be made perpendicular to the longitudinal axis of the dumbbell-shaped specimen. The two pieces of the specimen shall then be cemented together at the cut so as to re-form the original specimen with a cemented joint at the center of the restriction.

4.3.18.2 Procedure. The test specimens shall be tested with the same apparatus and procedure as specified in 4.3.17. The specimens shall not be tested sooner than 24 hours after cementing. Not less than two specimens shall be tested. One specimen shall be taken from the center of the sheet and the other shall be taken from one side of the sheet, keeping the surface intact. The test specimen shall be inspected after the test and the position of the break reported, whether at the cemented joint or elsewhere in the material itself. The average tensile strength of two specimens shall be reported. The average value shall meet the requirements of 3.5.

4.3.19 K-factor, thermal conductivity. The thermal conductivity of the insulation material shall be determined by the requirements of ASTM C 177. The material shall meet the requirements of 3.5.

5. PREPARATION FOR DELIVERY

5.1 Packaging. Packaging shall be level A or C, as specified (see 6.2).

5.1.1 Level A. The insulation material shall be separated with paper or other suitable separator sheets which will not adhere to or damage the rubber. The molded shapes shall be wrapped, boxed, or otherwise protected against deformation and abrasion.

5.1.2 Level C. Packaging shall be in accordance with the manufacturer's commercial practice.

5.2 Packing. Packing shall be Level A, B, or C, as specified (see 6.2). Containers shall contain identical amounts of material, be of uniform size, and be designed to enclose the contents in a snug, tight-fitting manner. The gross weight of boxes shall not exceed 200 pounds.

5.2.1 Level A. The insulation material shall be packed in a snug-fitting, overseas, exterior-type, cleated-fiberboard, cleated-plywood, nailed wood, cleated-veneer-kraft overlaid, or fiberboard boxes conforming to PPP-B-576, PPP-B-591, PPP-B-601, PPP-B-621, or PPP-B-636, respectively. Boxes shall be strapped in accordance with the appendix of the applicable box specification.

5.2.2 Level B. Unless otherwise specified, the rubber shall be packed in snug-fitting domestic-type cleated-fiberboard, cleated-plywood, nailed wood, cleated-veneer-kraft overlaid, or fiberboard boxes conforming to PPP-B-576, PPP-B-591, PPP-B-601, PPP-B-621, or PPP-B-636, respectively.

5.2.3 Level C. The insulation material shall be packed in a manner to insure carrier acceptance and safe delivery at destination. Containers shall be in accordance with Uniform Freight Classification Rules or regulations of other carriers applicable to the mode of transportation.

5.3 Marking of shipments. In addition to any special markings required by the contract or order unit packages and shipping containers shall be marked in accordance with MIL-STD-129.

6. NOTES

6.1 Intended use. The material covered by this specification is intended for application to metal panels of various structures for insulation purposes.

6.2 Ordering data. Procurement documents should specify the following:

(a) Title, number, and date of this specification

(b) Dimensions and tolerances (see 3.5)

(c) First article sample size and place where first article sample shall be sent (see 3.1)

(d) Any special lot size

(e) Level of protection required (see 5.1 and 5.2)

(f) Any special marking requirements (see 5.3).

Custodian:
Navy - OS

Preparing activity:
Navy - OS
(Project No. 5640-N016)

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SPECIFICATION ANALYSIS SHEET

Form Approved
Budget Bureau No. 22-R255

INSTRUCTIONS: This sheet is to be filled out by personnel, either Government or contractor, involved in the use of the specification in procurement of products for ultimate use by the Department of Defense. This sheet is provided for obtaining information on the use of this specification which will insure that suitable products can be procured with a minimum amount of delay and at the least cost. Comments and the return of this form will be appreciated. Fold on lines on reverse side, staple in corner, and send to preparing activity. Comments and suggestions submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or serve to amend contractual requirements.

SPECIFICATION MIL-I-16562A (OS), Insulation, Synthetic, Rubber-Like, Chemically Expanded, Cellular, (Sheet Form)

ORGANIZATION

CITY AND STATE

CONTRACT NUMBER

MATERIAL PROCURED UNDER A

☐ DIRECT GOVERNMENT CONTRACT ☐ SUBCONTRACT

1. HAS ANY PART OF THE SPECIFICATION CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE?

   A. GIVE PARAGRAPH NUMBER AND WORDING.

   B. RECOMMENDATIONS FOR CORRECTING THE DEFICIENCIES

2. COMMENTS ON ANY SPECIFICATION REQUIREMENT CONSIDERED TOO RIGID

3. IS THE SPECIFICATION RESTRICTIVE?

   ☐ YES ☐ NO *(If "yes", in what way?)*

4. REMARKS *(Attach any pertinent data which may be of use in improving this specification. If there are additional papers, attach to form and place both in an envelope addressed to preparing activity)*

SUBMITTED BY *(Printed or typed name and activity - Optional)*

DATE

DD FORM 1 JAN 66 1426

REPLACES EDITION OF 1 OCT 64 WHICH MAY BE USED.