

MIL-P-24249(SHIPS)

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MILITARY SPECIFICATION**PLASTIC MATERIAL, CELLULAR POLYURETHANE,
RIGID, VOID FILLER, POUR-IN-PLACE,
LARGE SCALE AND INSTALLATION OF****1. SCOPE**

1.1 This specification covers a resin system which after mixing and installation in a void will form a rigid, pour-in-place type unicellular urethane foam.

2. APPLICABLE DOCUMENTS

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

SPECIFICATIONS**MILITARY**

MIL-J-5624 — Jet Fuel, Grades JP-3, JP-4 and JP-5.

MIL-P-21929 — Plastic Material, Cellular Polyurethane, Rigid, Foam-In-Place, Low Density.

STANDARDS**MILITARY**

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

MIL-STD-401 — Sandwich Construction and Core Materials; General Test Methods.

HANDBOOK**MILITARY**

H106 — Multi-Level Continuous Sampling Procedures and Tables for Inspection by Attributes.

(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.

INTERSTATE COMMERCE COMMISSION

49 CFR 71-89 — Rules and Regulations for the Transportation of Explosives and Other Dangerous Articles.

(The Interstate Commerce Commission Regulations are now a part of the Code of Federal Regulations, available from the Superintendent of Documents, Government Printing Office, Washington, D.C. 20402.)

MIL-P-24249 (SHIPS)**OFFICIAL CLASSIFICATION COMMITTEE****Uniform Freight Classification Rules.**

(Application for copies should be addressed to the Official Classification Committee, 1 Park Avenue at 33rd Street, New York, N.Y. 10016.)

MANUFACTURING CHEMISTS ASSOCIATION, INC.**Manual L-1 — A Guide for Preparation of Warning Labels for Hazardous Chemicals.**

(Application for copies should be addressed to the Manufacturing Chemists Association, Inc., 1625 Eye Street, N.W., Washington, D.C. 20006.)

AMERICAN SOCIETY FOR TESTING AND MATERIALS**D1621 — Test for Compressive Strength of Cellular Plastics.****D1623 — Test for Tensile Properties of Rigid Cellular Plastics.****D1692 — Testing for Flammability of Plastics Foams and Sheet-ing.**

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

(Technical society and technical association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies.)

3. REQUIREMENTS

3.1 Qualification. Plastic material furnished under this specification shall be products and installation procedures which are qualified for listing on the applicable qualified products list at the time set for opening of bids (see 4.2 and 6.4).

3.2 Coring. After installation, pours shall be tested as specified (see 4.4).

3.3 Ingredients. When mixed in accordance with the operating instructions and automatic dispensing equipment specified by the supplier (see 3.4.7 and 6.3), the ingredients shall form a rigid unicellular urethane foam suitable for the intended application. The foam shall air cure at ambient temperature, the minimum of which may be specified by the Command or agency concerned (see 6.2) and shall attain the physical properties specified in table I within 7 days after mixing.

3.4 Foamed material.

3.4.1 Quantity per single pour. The automatic dispensing equipment used shall dispense foam at a rate specified by the Command or agency concerned (see 4.2.2.1.1 through 4.2.2.1.3, 6.2 and 6.3).

3.4.2 Uniformity.

3.4.2.1 Single pour. The material shall be essentially homogeneous (uniform physical properties) throughout and firm in composition with small uniform cells. There shall be no large void openings (over 1/2 inch in any direction), large accumulations of unexpanded resin or other occlusions. The core selected after installation (see 4.4.3.3), shall not show cracks or separation.

3.4.2.2 Multiple pours. Each individual pour shall have the uniformity specified in 3.4.2.1. The fusion line between successive pours shall be well knit and shall not show separation, cracks, or any significant amount of non-uniformity such as air bubbles or larger than normal cells.

3.4.3 Color. The color shall be the natural color of the product.

3.4.4 Odor. The cured material shall be free from any objectionable odor.

3.4.5 Property values. The foam material tested as specified in 4.6 shall conform to the property values specified in table I.

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TABLE 1. *Physical requirements and standard test specimens.*

Property	Test paragraph	Requirement	Test specimens	
			Number	Size, inches
Density of foamed block, pounds per cubic feet	4.6.4.1	6.4 maximum	1	Sample block
Compressive strength at 10 percent deflection perpendicular to foam rise, pounds per square inch (p.s.i.)	4.6.4.2	Greater than 80 but less than 110	2	2¼ by 4 by 6
Compressive strength at 10 percent deflection-parallel to foam rise, p.s.i.	4.6.4.2	80 minimum	2	2¼ by 4 by 6
Tensile strength-perpendicular to foam rise, p.s.i.	4.6.5	80 minimum	3	Type A specimen of ASTM D1623
Shear strength-perpendicular to foam rise, p.s.i.	4.6.6	50 minimum	3	½ by 2 by 6
Unicellularity-percent open cell	4.6.7	15 maximum	3	Approximately 1 by 1.129 dia.
Water absorption-lbs/sq.ft. of cut surface	4.6.8	0.10 maximum	5	1 by 4 by 4
Resistance to JP 5 fuel	4.6.9	No deterioration	3	Approximately 1 by 1.129 dia.
Humid aging-volume change percent	4.6.10	± 5 maximum	5	2¼ by 4 by 6
Compressive strength at 10 percent deflection, perpendicular to foam rise, p.s.i. (after humid aging).	4.6.10	Greater than 80 but less than 110	—	—
Fire resistance, seconds	4.6.11	Self extinguishing; 20 maximum	5	½ by 2 by 6
Adhesion in tension, p.s.i.	4.6.12	80 minimum	3	4 by 4 by 4

3.4.6 *Identification of product.* Each container of foam ingredients shall be suitably tagged or marked using water, grease and oil resistant materials with the following information and as specified in 5.1.1.3.

(a) Density (nominal) of resultant foam (only on resin containers).

(b) Military specification number.

(c) Net weight of material.

(d) Date of manufacture and code number.

(e) Date before which material must be used.

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- (f) Recommended storage procedure (if any).
- (g) Recommended formulation (only on resin containers).
- (h) Handling and safety precautions (if any).
- (i) Foam supplier's name.

3.4.7 Foam supplier's instruction sheet.

The foam supplier shall provide instructions sheets on the foam system for test and installation purposes. The instruction sheet shall contain the following data:

- (a) Military specification number.
- (b) Foam supplier's code number.
- (c) Nominal density of the foamed material (free blown).
- (d) Ingredients:
 - (1) Foam supplier's commercial designation.
 - (2) Recommended formulation (exact proportions in which ingredients are mixed) for automatic dispensing.
- (e) Recommended storage procedure.
- (f) Usable storage life.
- (g) Handling precautions.
 - (1) *Mixing instructions.* Include complete mechanical and operational details of the automatic dispensing equipment to be used. Include handling qualities of the foam such as mix time, rise time and minimum

and maximum time intervals (if applicable) between successive pours.

3.5 Workmanship. Workmanship shall be such as to assure a uniform product complying with this specification.

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, the supplier may utilize his own facilities or any commercial laboratory acceptable to the Government. The Government reserves the right to perform any of the inspections set forth in the specifications where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.2 Qualification¹. Qualification tests shall be conducted at a laboratory satisfactory to the Naval Ship Engineering Center.

4.2.1 Prior approval of plastic material. Prior to authorization for qualification, the supplier shall submit to the Naval Ship Engineering Center, for review and approval, technical data indicating compliance to all the physical property requirements of table I. The procedure for qualification shall be as follows:

- (a) Follow 4.2.1 using the sampling procedure of 4.2.1.1.
- (b) Failure to meet the requirements of (a) terminates the qualification process.
- (c) After successful completion of (a), the supplier will proceed to complete 4.2.2 and 4.2.2.1.

¹ Copies of "Provision Governing Qualification" may be obtained upon application to Commanding Officer, Naval Supply Depot, 5801 Tabor Avenue, Philadelphia, Pennsylvania 19120.

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- (d) Non-acceptance of the Naval Ship Engineering Center of the supplier's data submitted (see (c)) will terminate the qualification process.
- (e) After successful completion of (c), the Naval Ship Engineering Center may authorize a qualifying mock-up pour demonstration detailed in 4.2.2.2.
- (f) Non-acceptance of the results of (e) terminates the qualification process.
- (g) Acceptance of the results of (e) by the Naval Ship Engineering Center will result in the supplier of the candidate system being granted qualification approval.

4.2.1.1 Samples for testing shall be randomly selected from foam cast in accordance with 4.6.2.1.1 and tested in accordance with 4.6. A repeat pour shall be made using the same lot of materials, equipment, pouring procedure and ambient conditions and the results reported. Tests on the repeat pour shall be limited to density and compressive strength (perpendicular to foam rise). For both pours samples for density and compressive strength shall be randomly selected from a minimum of five locations within the test mold and shall be representative of all four sides and the center.

4.2.1.1.1 If the supplier fails to meet any of the requirements, authorization will not be granted for the qualification tests, until the supplier demonstrates his ability to meet all these requirements.

4.2.2 For the initial step in the qualification process, the supplier shall describe, in writing, to the Naval Ship Engineering Center, SEC 6101E, has candidate foam system, proposed installation procedure (method A or B) and complete quality assurance tests (before and after installation in ship's com-

partments), which would be used throughout the ship's installation.

4.2.2.1 The following information, from the supplier, shall be supplied to the Naval Ship Engineering Center, for evaluation and acceptance before authorization can be granted for demonstration mock-up pours to complete the qualification process:

- (1) Indicate physical properties of candidate foam system showing compliance to table I.
- (2) Indicate proposed installation procedure to be followed during ship's installation (method A or B). Furnish Naval Ship Engineering Center with the required information specified in 4.2.2.1.1, 4.2.2.1.2 and 4.2.2.1.3, as appropriate.

4.2.2.1.1 *Method A — preformed foam blocks within a pour-in-place foam matrix.* The supplier shall report:

- (a) Optimum number of preformed foam blocks to be placed in each compartment of the ship.
- (b) Optimum size of preformed blocks to be placed in each compartment of the ship.
- (c) Optimum block distribution and positioning within the poured-in-place foam matrix.
- (d) Percent by volume represented by the preformed foam blocks within each compartment (approximately).

4.2.2.1.2 *Method B—pour-in-place foam system, without preformed foam blocks.* The supplier shall describe the complete system to be used to pour all foam-in-place material in compartments.

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4.2.2.1.3 For both methods A and B the following additional information shall be furnished to and subject to acceptance by the Naval Ship Engineering Center before a demonstration mock-up pour can be authorized.

- (a) Pouring procedure to be followed in ship's compartments.
- (b) Full description of foam equipment, hoses and accessories to be used in the installation.
- (c) Quality assurance procedure to be followed by the supplier to provide 95 percent assurance that installed material will meet the physical requirements of the ship's specification. This plan will require procedures for testing foam before and after shipboard installation. A description of the proposed foam installation Quality Control reports and time limit for reporting results to Naval Ship Engineering Center on site representatives.
- (d) Physical property description (see table I), of the foam material used in methods A and B, whichever is selected by the contractor.

4.2.2.2 *Qualifying mock-up pour demonstrations.*

4.2.2.2.1 Insofar as practicable, all mixing equipment, metering pumps, hoses, dispensing equipment and accessories shall duplicate expected shipboard operating conditions.

4.2.2.2.2 For purposes of qualifying mock-up pour demonstrations, a 4 by 8 by 14 foot simulated compartment shall be constructed in accordance with 4.6.2.1.2

4.2.2.2.3 If method A is followed (see 4.2.2.1.1), in the original 4 by 8 by 14 foot demonstration mock-up mold, filling of a sec-

ond demonstration mock-up mold 4 by 4 by 4 foot shall be required, following pouring method B.

4.2.2.2.4 If method B is followed (see 4.2.2.1.2), in the original 4 by 8 by 14 foot demonstration mock-up mold, filling of a second demonstration mock-up mold 4 by 4 by 4 foot shall not be required.

4.3 Sampling for qualification testing (mock-up pour).

4.3.1 *Preformed foam blocks, when pouring method A is followed.* A total of 16 blocks, or as specified by the Command or agency concerned (see 6.2), of the size specified in 4.2.2.1.1, shall be poured and tested to demonstrate the ability of the supplier to produce homogeneous unicellular foam blocks of uniform compressive strength (perpendicular to foam rise) density, cell size, and foam blocks shall be free from cracks and un-cured or partially cured foam and surface skin material. All 16 blocks shall be poured from the same batch of resin and the same batch of isocyanate without any formulation changes. The pouring procedure shall be accomplished under ambient temperature conditions. These blocks shall be poured in groups of 4 at intervals of 24 hours between group pourings.

4.3.1.1 *Specimens from blocks.* Four test specimens, each $2\frac{1}{4}$ by 4 by 6 inches, shall be randomly selected and cut from each of the 16 blocks, as specified in 4.3.1. The $2\frac{1}{4}$ inch dimension to be tested shall be cut perpendicular to the direction of foam rise. The specimens shall be tested in accordance with 4.6 and shall meet all the physical property requirements of table I.

4.3.1.1.1 *Properties of sample preformed foam blocks.* The compression strength of each individual test specimen shall be greater than 80 p.s.i. but less than 110 p.s.i. The mean of all 64 test specimens shall be above 95 p.s.i. but not above 102.5 p.s.i. The density range for the 64 specimens shall not exceed a range of 0.75 pounds per cubic foot.

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4.3.1.2 *Preformed foamed blocks* within poured foam matrix, when pouring method A is followed. A simulated ship compartment (see 4.6.2.1.2) shall be constructed and preformed and pretested foam blocks positioned in the compartment in accordance with 4.2.2.1.1 and 4.2.2.1.3, and shall form multiple layers within a poured-in-place foam matrix. After the pour-in-place foam matrix has cooled sufficiently for testing purposes, 20 samples of matrix material shall be cut out representing all parts, from the center, top, bottom, and four sides. Density and compressive strength (perpendicular to the direction of foam rise) shall be determined on two specimens cut from each of the 20 samples. Density and compressive strength results shall meet the requirements of 4.3.1.1.

4.3.2 *Sampling of matrix foam test pours; when preformed foam blocks are included (method A).*

4.3.2.1 *Sampling of plastic foam poured around preformed foam blocks (matrix foam bucket tests).* Concurrently with the pouring of the foam matrix material around the preformed foam blocks, samples of the foam matrix shall be poured into suitable containers. The size, shape and composition of which is to be determined during the qualifying process (see 4.2.2.1). Test specimens 4 by 6 by 18 inches shall be cut and tested for compressive strength (perpendicular to the direction of foam rise) and density. The 4-inch dimension shall be perpendicular to the direction of foam rise. One such specimen shall be poured for each layer of matrix. Tests shall be performed, as soon as possible after pouring in order to provide information and guidance for any necessary adjustment of materials or mixing equipment (see 4.4.3.4).

4.3.2.2 *Sampling of plastic foam poured around preformed foam blocks (matrix foam bucket tests).*

4.3.3 *Sampling of all-poured-in-place foam, when pouring method B is followed.* A simulation of ship compartment installation shall be made (see 4.2.2.1.2 and 4.2.2.1.3). Foam rise shall be in the 14 foot direction

After curing is sufficiently complete, 120 samples shall be randomly cut out, an equal number from each layer, to provide 40 test specimens, each 2 1/4 by 4 by 6 inches; the dimension 2 1/4 inches to be perpendicular to the direction of foam rise. Tests of compressive strength (perpendicular to the direction to foam rise) and density shall be made on each specimen (see 4.4.3.2).

4.4 *Quality conformance inspection.*

4.4.1 *Lot.* For purposes of sampling, a lot shall consist of all components of the foam system, each manufactured as one batch and offered for delivery at one time.

4.4.2 *Sampling and testing.*

4.4.2.1 *Source inspection.* From each lot (see 4.4.1) a sufficient quantity of foam resin material shall be taken for the molds, specifying 4.6.2.1.1 and 4.6.2.1.3. The mold samples shall be foamed, prepared and tested as specified in 4.6.1. If a sample fails in any of the tests specified in 4.6, the foam manufacturer shall be notified, the tests rerun on a fresh sample with government representatives present. If the new sample fails any of the tests specified in 4.6, this shall be cause for rejection of the lot represented by the sample.

4.4.2.2 *Prior to installation inspection by installer.* Sampling and testing shall be as specified in 4.4.2.1, except that only the tests of 4.6.4.1 and 4.6.4.2 (perpendicular to the direction of foam rise) shall be run using the mold specified in 4.6.2.1.1. These tests shall be conducted at the contractor's laboratory. The test of 4.6.2.1.3 shall not be required.

4.4.3 *Quality conformance inspection, preceding, during and after installation in the large scale voids.*

4.4.3.1 *Sampling of production preformed foam blocks, when pouring method A is followed.* Production preformed foam blocks

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shall be selected in accordance with H106 for $f = \frac{1}{2}$ and $k = 4$ and AOQL ≈ 3.0 percent defective. The quantity N = contract size shall be the number of blocks which is expected to be made from one batch of resin. When a new batch of either component is used, the sampling schedule shall be repeated at the rate $f = \frac{1}{2}$. Two test specimens representing center and side (furthest from center) of blocks $2\frac{1}{4}$ by 4 by 6 inches shall be cut from each of the selected sample blocks. Compressive strength (perpendicular to the direction of foam rise) and density shall be determined for each specimen.

4.4.3.2 Sampling of poured-in-place production foam, for either method A or B. Concurrently with the pouring in ship compartments, samples of the foam mix shall be poured into suitable containers. The size, shape and composition of which is to be determined during the qualifying process (see 4.2.2.1). Each container shall provide one test specimen 4 by 6 by 18 inches (4 inches in direction of foam rise). One such test sample shall be provided for approximately every 200 cubic feet of compartment space filled. Density and compressive strength (perpendicular to the direction of foam rise) shall be determined on each sample as rapidly as possible in order to provide information and guidance for any necessary adjustment of materials or mixing equipment (see 4.4.3.4).

4.4.3.3 Coring after installation. After sufficient curing of the plastic foam in the large scale voids has occurred, one test sample, sufficient for two specimens, shall be cut out at each access opening. These specimens shall be cut from any layer except the first two layers poured and the last two. Cores shall pass through an interface. Both test specimens shall not represent the same foam layer. Size of specimens tested shall be $2\frac{1}{4}$ by 4 by 6 inches ($2\frac{1}{4}$ inch dimension shall be perpendicular to the direction of foam rise). Density and compressive strength tests shall be made on each specimen. Failure of test coring to pass

these tests shall, after a review of the data obtained from 4.4.3.2, be sufficient cause for removal of the already installed foam in bays represented by the test corings. Visual inspection shall conform to 3.4.2.2.

4.4.3.4 In order that quality trends can be monitored throughout the large scale pour installation, the contractor shall maintain a daily log and graphs relating the density and compression strength (perpendicular to direction of foam rise) of sample cores for each machine used and for each crew as well as for all machines and crews combined (see 4.4.3.2). This log is to be used by the contractor to adjust his process as required.

4.4.4 Refilling of test core voids. Test core voids shall be refilled with foam material that will continue to meet all the requirements of this specification.

4.5 Examination of filled containers. A random sample of filled containers shall be taken from each lot in accordance with MIL-STD-105 at inspection level I and acceptable quality level = 2.5 percent defective to verify compliance with requirements regarding fill, closure, marking and all other requirements not involving tests. Containers shall be examined for defects of construction of the container and closure, for evidence of leakage and for unsatisfactory markings. Each sample filled container shall also be weighed to determine the amount of contents. Any container in the sample, having one or more defects, or under-required fill, shall be subject to rejection and if the number of defects, in any sample exceeds the acceptance number for the appropriate sampling plan of MIL-STD-105, this shall be cause for rejection of the lot represented by the sample.

4.6 Test procedure.

4.6.1 Test conditions. Unless otherwise specified (see 6.2), the atmospheric conditions surrounding the specimen prior to and during the test shall be $23^{\circ} \pm 1^{\circ}\text{C}$. (73.4°

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$\pm 2^{\circ}\text{F.}$) and 50 plus or minus 2 percent relative humidity. The temperature, relative humidity, and the period of time for conditioning shall be recorded for each test. Results shall be reported as the average value for the number of specimens tested, except compressive strength for which all individual values shall be reported.

4.6.2 Preparation of sample molds.

4.6.2.1 Sample molds.

4.6.2.1.1 *For lot testing.* The mold shall be a $\frac{1}{2}$ inch steel box without a top having dimensions of 2 by 4 feet in cross section and 1 foot high. The four walls and bottom shall be solid. The bottom and sides shall be so constructed that the mold can be disassembled. A mold release agent acceptable to the foam formulator shall be used.

4.6.2.1.2 *Mock-up section (for qualification testing).* The mock-up section shall be 4 by 8 by 14 foot, or as specified by the Command or agency concerned (see 6.2 and 6.3). The mold requirements shall include such information as thickness of the material (steel), size of openings, dimensions of the mold, and top or no top configuration. The mold requirements shall also indicate when structural members, piping, or other simulated internal obstructions are required in the mock-up to obtain information about flow properties of the foam. The mock-up should be able to be disassembled and a release agent acceptable to the foam formulator shall be used for ease of disassembly. Access to mock-up section shall simulate ship's construction.

4.6.2.1.3 *For adhesion testing.* The mold for adhesion testing shall be as follows: The mold shall be $\frac{3}{4}$ inch plywood box without a top whose dimensions are approximately 14 inches long by 7 inches high by 5 inches wide. Zinc chromated primed steel plates, whose dimensions are 4 inches by 4 inches by $\frac{1}{2}$ inch thick shall be bolted to

the 7 inch by 14 inch sides in such a manner that the zinc chromated faces and the edges of the plates on opposite sides of the mold are parallel to each other with the gap between the faces of the steel plate equal to four inches. The mold shall be so constructed that the four sides and the bottom can be disassembled and for easy disassembly, the inside except for the steel plates shall have a mold release agent acceptable to the foam supplier.

4.6.2.2 *Sample preparation.* Foaming and handling characteristics of the material shall be determined during the preparation of the test samples (see 3.3 and 3.4.7). A quantity of foam ingredients sufficient for the sample molds of 4.6.2.1.1, 4.6.2.1.2 and 4.6.2.1.3 using the automatic equipment specified by the foam formulator (see 3.3, 3.4.1 and 3.4.7) shall be taken as applicable and then poured. At the option of the Command or agency concerned, the first fill of the mock-up section mold of 4.6.2.1.2 may be limited to approximately one third of the total depth of the mold to first determine compliance to 3.4.2.2. Failure to meet the requirements of 3.4.2.2 shall terminate qualification testing and shall be sufficient cause for rejection of the material. If the material meets the requirements of 3.4.2.2 the sampling procedure of 4.3 shall be followed. A second filling of the mock-up mold of 4.6.2.1.2 to the 14 foot height shall follow successful completion and acceptance of the results by the Command or agency concerned. The sampling procedure of 4.3 shall be followed. When pouring method A or B is employed, single test pour depth measured (after rise) shall be the same depth which the supplier (foam installer) will employ in the large scale foam installation.

4.6.2.2.1 *Precautions.* Isocyanate fumes may be present when the foam system is prepared. Adequate ventilation should be provided, if not, air masks should be worn. Goggles, rubber gloves and coveralls should be worn to protect against splattering during preparation of the foam.

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After determining the density as specified in 4.6.4 one half of the sample block shall be cut into 1 inch or $2\frac{1}{4}$ inch thick layers as indicated in table I. The thickness of these layers shall be perpendicular to the direction of foaming except for one $2\frac{1}{4}$ inch layer which shall be parallel. The other half shall be used to prepare tensile specimens. For the tensile specimens, the thickness shall be parallel to the rise of foam. All specimens shall be free of skin and shall be prepared in such a manner that the possibility of heating is minimized. Specimens for test shall not be heated, immersed in water or subjected to any mechanical or chemical treatment prior to test except as specifically described herein. The number and size of the specimens for each test (except adhesion) as specified in table I shall be prepared from the 1 inch or $2\frac{1}{4}$ inch thick layers as indicated in table I. Unless otherwise specified herein, test specimens shall be selected at random from the prepared 1-inch and $2\frac{1}{4}$ inch thick layers as required. Prior to testing, each 1 by 4 by 4 inch specimen and $2\frac{1}{4}$ by 4 by 6 inch specimen shall be weighed to the nearest 0.1 gram. Each 1 inch by approximately 1.129 inch diameter specimen to the nearest 0.001 gram, the dimensions shall be measured to the nearest 0.01 inch and 0.001 and density calculated. Any specimen whose density is not within 5 percent of that of the sample block shall be subject to rejection and replaced with a suitable new specimen. Specimens for compressive strength and change in compressive strength after humid aging shall be cut from the same $2\frac{1}{4}$ inch thick layers of foam.

4.6.3.2 Mold for adhesion (see 4.6.2.1.3).

After curing the foam for 7 days, less if fully cured before this time, the mold shall be disassembled, and the excess foam adhering to the edges of the steel plates shall be removed. The specimens shall be prepared by trimming off the excess foam to form a specimen whose dimensions are 4 by 4 inches

with the thickness of the foam core between the steel plates equal to 4 inches.

4.6.3.3 Mock-up mold (see 4.6.2.1.2). Samples shall be selected and tested in accordance with 4.3. All the tests specified in 4.6 shall be conducted on each of these samples. Test specimens from these samples shall be prepared as specified in 4.6.3.1.

4.6.4 Density and compressive strength tests.

4.6.4.1 Density. Irregular surfaces of the foam samples (such as the domed surface of the sample) shall be cut off to permit convenient measurement of dimensions. The density of the foam shall be determined by dividing its weight to the nearest $\frac{1}{4}$ pound by its volume calculated from dimensions measured to the nearest $\frac{1}{16}$ inch. Density expressed in pounds per cubic foot =

$$\frac{\text{weight in pounds}}{\text{volume (cubic inches)}} \times 1728.$$

4.6.4.2 Compressive strength. The compressive strength shall be determined by procedure A of ASTM D1621, (except that the report of average value does not apply), the number and size specimens shall be as indicated in table I. Each individual value shall be reported.

4.6.4.3 Density and compressive strength (perpendicular to direction of foam rise at the site of installation). The number of tests for density and compressive strength (perpendicular to direction of foam rise), required per day for the large scale installation shall be determined as specified in 4.2.2.1.

The tests shall be made on foam from each mixing head in use during the large scale installation. Daily log and graphs relating to the density and compressive strength shall be maintained.

4.6.5 Tensile strength. The tensile strength shall be determined by ASTM method D1623,

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type A specimen except that the number of specimens shall be as indicated in table I.

4.6.6 Shear strength. The shear strength shall be determined by the two plate core shear method of MIL-STD-401 using the number and size of specimens indicated in table I.

4.6.7 Unicellularity. Unicellularity shall be determined by the unicellularity procedure specified in MIL-P-21929.

4.6.8 Water absorption. After measuring the dimensions to the nearest 0.01 inch, the specimen shall be completely immersed in a horizontal position under a 2-inch head of water (at 65° - 90°F.) for 10 seconds. This may be done by placing the specimen under a weighted, perforated corrosion resistant metal screen. Remove the specimen after the 10 second immersion and allow it to drain for 10 seconds in still air on a (1/4 inch by 1/4 inch) screen at an angle of 30 degrees from the vertical and weigh. This weight shall be taken as the initial weight of the specimen. The specimen shall then be subjected to a 10-foot head of water (at 65° - 90°F.). After 48 hours the specimen shall be removed from the water, drained in the same manner as employed for the initial weight, and weighed. The difference between the final (wet) and the initial (dry) weighing will be the water pickup by the specimen. The water absorption shall be expressed in terms of pounds per square foot of cut surface.

4.6.9 Oil resistance. The specimen shall be immersed in fuel oil conforming to MIL-J-5624. After 70 hours, the specimen shall be removed, lightly blotted with paper towel and compared to an unaged specimen of similar size for evidence of softening or dissolving.

4.6.10 Humid aging test. After measuring dimensions to the nearest 0.001 inch, the specimen shall be placed on a rack in closed container having approximately one inch of

water in the bottom. The top of the container shall be equipped with a hole for the insertion of a stirring rod. The container shall be placed in an oven maintained at 158° ± 2°F. for 7 days. A suitable air-stirring device shall be inserted through the top of the container and operated for the first four to six hours of the exposure to ensure an atmosphere of 100 percent relative humidity within the container. The water level should be checked periodically throughout the exposure. If addition of water is required, it should be preheated to 158°F. After 7 days, the specimen shall be removed from the container, dried for 30 minutes at 158°F. and allowed to recover for 1 hour under standard conditions specified in 4.6.1. The specimen shall be measured to determine volume change which shall be expressed as a percent of initial volume. The specimens shall also be used for a determination of compressive strength after humid aging using the procedure described in 4.6.4.2. If the 2 1/4 by 4 by 6 inch specimens show any warping after humid aging, test specimens whose area is at least 4 square inches shall be cut from the specimens and used for the compressive strength test.

4.6.11 Fire resistance. The fire resistance shall be determined in accordance with ASTM D1692, except that the number of specimens shall be as specified in table I.

4.6.12 Adhesion in tension. The specimens prepared as specified in 4.6.3.2, shall be attached by means of a center screw to blocks which are suitable for attachment to the grip assembly specified for type B specimens of ASTM D1623. The tensile strength shall be determined in accordance with the procedure specified in ASTM D1623 except that the number and size of specimens shall be as specified for the adhesion test in table I.

5. PREPARATION FOR DELIVERY

5.1 Domestic shipment and early use.

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5.1.1 *Foam plastic material.*

5.1.1.1 Packaging. Packaging shall be sufficient to afford adequate protection against corrosion, deterioration and physical damage during shipment from the supply source to the using activity and until early installation and may conform to the supplier's commercial practice when such meets these requirements.

5.1.1.2 Packing. Packing shall be accomplished in a manner which will insure acceptance by common carrier, at lowest rate, and will afford protection against physical or mechanical damage during direct shipment from the supply source to the using activity for early installation. The shipping containers or method of packing shall conform to the Uniform Freight Classification Rules and Regulations or other carrier regulations as applicable to the mode of transportation and may conform to the supplier's commercial practice when such meets these requirements.

5.1.1.3 Marking. In addition to the special marking required by 3.4.6, shipment marking information shall be provided on interior packages and exterior shipping containers in accordance with the contractor's commercial practice. The information shall include nomenclature, Federal stock number or manufacturer's part number, contract or order number, contractor's name, and destination.

5.1.1.3.1 Hazardous chemicals. All packages containing hazardous chemicals shall have securely affixed thereto such warning labels with marking requirements as are required by are Interstate Commerce Commission CFR Title 49 parts 71-78, and the Manufacturer's Chemists Association Manual L1.

6. NOTES

6.1 Intended use. The material is in-

tended for shock absorption in large void filling applications.

6.2 Ordering data. Procurement documents should specify the following:

- (a) Title, number and date of this specification.
- (b) Handling characteristics required (see 3.3, 3.4.1, 4.6.2.1.2 and 4.6.2.2).
- (c) Where test pours shall be made, foam rate, depth per pour after rise, minimum time required between vertical successive pours, minimum time required before coring of pour can be made, minimum time for test specimens to reach maximum physical properties after coring, quantity of foam in any single pour (see 3.4.1, 4.2, 4.4.1 and 4.6.2.2).
- (d) Number of preformed test blocks, if other than specified (see 4.3.1).
- (e) Atmospheric conditions, if different (see 4.6.1).
- (f) Mock-up requirement (see 4.6.2.1.2).
- (g) Area of mock-up section from which samples are to be cut (see 4.6.3.3).
- (h) Total quantity of foam required.

6.3 Automatic equipment. The following information should be provided to the foam formulator so that a satisfactory piece of automatic equipment can be provided:

- (a) Mock-up model construction (see 4.6.2.1.2 and 6.2).
- (b) Foam rate and quantity per pour (see 3.4.1 and 6.2).

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- (c) Application procedure — at what stage in the ship building program will the foam installation be done.
- (d) Number and size of core samples required (see 4.4.3.3).
- (e) Number of test pours required from each machine during large scale installation (see 4.2 and 4.4.3.2).
- (f) Refill of core voids (see 4.4.4).

6.4 With respect to products requiring qualification, awards will be made only for products which are at the time set for opening of bids, qualified for inclusion in applicable Qualified Products List-24249 whether or not such products have actually been so

listed by that date. The attention of the suppliers is called to this requirement, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification, in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. The activity responsible for the qualified products list is the Naval Ship Engineering Center, Department of the Navy, Washington, D.C. 20360, and information pertaining to qualification of products may be obtained from that activity. Application for Qualification tests shall be made in accordance with "Provisions Governing Qualification" (see 6.5).

6.5 Copies of "Provisions Governing Qualification" may be obtained upon application to Commanding Officer, Naval Supply Depot, 5801 Tabor Avenue, Philadelphia, Pennsylvania 19120.

Preparing activity:

Navy—SH

(Project 9330-NO18Sh)

SPECIFICATION ANALYSIS SHEET

Form Approved
Budget Bureau No. 119-R004INSTRUCTIONS

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 (as indicated on reverse hereof).

SPECIFICATION

ORGANIZATION (of submitter)

CITY AND STATE

CONTRACT NO.

QUANTITY OF ITEMS PROCURED

DOLLAR AMOUNT

\$

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)

DATE

DD FORM 1426
1 APR 63REPLACES NAVSHIPS FORM 4863, WHICH IS OBSOLETE
(NAVSHIPS OVPRT 12-66)

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