

INCH-POUND

MIL-R-21607E(SH)

25 May 1990

SUPERSEDING

MIL-R-21607D(SH)

5 August 1976

(See 6.8)

MILITARY SPECIFICATION

RESINS, POLYESTER, LOW PRESSURE LAMINATING, FIRE-RETARDANT

This specification is approved for use by the Naval Sea 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 covers translucent resins used to fabricate fire-retardant glass reinforced plastic laminates for use in boats, tanks, and other Naval applications.

1.2 Classification. Resins shall be of the following grades, as specified herein (see 3.2 and 6.2):

Grade A - Standard flame resistance.

Grade B - Superior flame resistance.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Naval Sea Systems Command, SEA 5523, Department of the Navy, Washington, DC 20362-5101 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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SPECIFICATIONS

FEDERAL

QQ-R-175 - Resistance Wire.

MILITARY

MIL-R-7575 - Resin, Polyester, Low-Pressure Laminating.

MIL-C-9084 - Cloth, Glass, Finished, for Resin Laminates.

MIL-C-19663 - Cloth, Woven Roving, for Plastic Laminate.

STANDARD

FEDERAL

FED-STD-313 - Material Safety Data, Transportation Data and Disposal Data for Hazardous Materials Furnished to Government Activities.

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Standardization Documents Order Desk, BLDG. 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Qualification. Resins furnished under this specification shall be products which are authorized by the qualifying activity for listing on the applicable qualified products list at the time of award of contract (see 4.3 and 6.4).

3.2 Material. The resin shall meet the requirements for grades A or B of MIL-R-7575 as specified (see 6.2) and the additional requirements specified herein. When used in accordance with material contractors' recommendations, the resin shall be for use in contact or vacuum bag processes with cure temperatures between 55 to 81 degrees Fahrenheit ($^{\circ}$ F) (13 to 27 degrees Celsius ($^{\circ}$ C)).

3.3 Flame resistance. Weathered (see 3.5) and unweathered resin test panels shall meet the requirements of table I (see 4.5 and 4.6).

TABLE I. Flame resistance requirements.

	Average ignition time (seconds)	Average burning time (seconds)
	Minimum	Maximum
Grade A	55	125
Grade B	70	65

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3.4 Resin content. The resin content for test panels shall be 38 to 44 percent, and shall be determined as specified (see 4.5 and 4.7).

3.5 One-year weathering. Panels fabricated in accordance with 4.5 shall be exposed to outdoor weathering (see 4.8) for a period of 1 year. These panels shall meet the flame resistance requirements of 3.3 after the 1-year period (see 4.6).

3.6 Additives. The resin shall not include any opaque additives. The use of a translucent additive to achieve grade B is permitted provided the required visual examination is not precluded and resin reinforcement wet-out time is as specified in MIL-C-19663.

3.7 Material safety data sheet (MSDS). The contracting activity shall be provided a material safety data sheet at the time of contract award. The MSDS shall be provided in accordance with the requirements of FED-STD-313. The MSDS shall be included with each shipment of the material covered by this specification (see 6.5).

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements (examinations and tests) 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 ensure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items shall meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of the manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

4.2 Classification of inspections. The inspection requirements specified herein are classified as follows:

- (a) Qualification inspection (see 4.3).
- (b) Quality conformance inspection (see 4.4).

4.2.1 Inspection conditions. Unless otherwise specified (see 6.2) all inspections shall be performed in accordance with the test conditions specified herein.

4.3 Qualification inspection. Qualification inspection shall be conducted at a laboratory satisfactory to the Naval Sea Systems Command. Qualification tests specified in 4.6 through 4.8, shall be conducted on laminates conforming to 4.5.

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4.4 Quality conformance inspection. Quality conformance inspection shall be in accordance with MIL-R-7575 (see 6.3).

4.4.1 Sampling for quality conformance inspection. Sampling for quality conformance inspection shall be in accordance with MIL-R-7575.

4.4.2 Rejection criteria. Rejection criteria for quality conformance inspection shall be in accordance with MIL-R-7575.

4.5 Fabrication of laminates for tests. Glass reinforced plastic panels shall be fabricated in the form of sheets, nominally 0.5 inch (12.7 millimeters (mm)) thick and 12 by 12 inches (30.5 by 30.5 centimeters (cm)) in size. The cloth shall conform to type XII or XIIA, class 1 of MIL-C-9084. Forty plies of cloth shall be impregnated with catalyzed resin and press cured to 0.5 inch (12.7 mm) stops at such temperature and pressure as will provide a fully cured laminate with a resin content of 38 to 44 percent (see 4.7) and a Barcol hardness of 45 minimum. The resin used shall meet the requirements of 3.2, 3.3, 3.4 and 3.6.

4.6 Flame resistance test.

4.6.1 Test specimens. Five specimens, each measuring 5 by 0.5 by 0.5 inch (12.7 by 1.27 by 1.27 cm) shall be tested.

4.6.2 Test apparatus.

4.6.2.1 Enclosure. An enclosure large enough to contain the specimen, supports, heater coil, spark plugs, flame travel gauge, and their associated accessories shall be arranged to eliminate air drafts and permit a clear view of the interior through shatterproof glass windows. Vent holes distributed around the sides adjacent to the base shall be provided to admit fresh air when an exhaust fan, which is connected to the top of the enclosure, is operated at a minimum suction just sufficient to carry off smoke and gases.

4.6.2.2 Supports. Top and bottom supports shall hold the specimen in a vertical position. The unsupported span between the supports shall be a minimum of 4 inches (10 cm). The lower end of the specimen shall be wrapped in such a manner that gases released through this end are diverted toward the spark plugs.

4.6.2.3 Heating coils. Heating coils shall consist of seven turns of no. 10 (0.102 inch (0.26 cm) diameter) resistance wire, QQ-R-175 grade E, space wound to 0.25 inch (0.64 cm) per turn. The nominal inside diameter of the coil used shall be 1.19 inches (3.02 cm). The lower end of the heater coil shall be located 1.5 inches (3.81 cm) above the top of the lower specimen support.

4.6.2.4 Spark plugs. Two spark plugs with extended electrodes spaced 0.125 inch (0.32 cm) from the surface of the specimen shall be located on diametrically opposite sides of the specimen. The spark plugs shall be placed with their longitudinal center lines in a horizontal plane 0.5 inch (1.27 cm) above the top of the heater coil to ignite the gases emitted from the heated specimen. An electric circuit shall be provided to maintain continuous sparking at the electrodes during the specified time. The spark plugs shall be mounted so they may be moved away from the specimen after ignition takes place so as not to impede the travel of the flame and to prevent their electrodes from becoming fouled by soot.

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4.6.3 Test procedure.

4.6.3.1 Ignition time. With the specimen centered in the heater coil, and the spark plugs and flame gauge properly located, the enclosure shall be closed and ventilated. A stop watch shall be started simultaneously with the energizing of the heater coil and spark plugs. A constant current of 55 amperes shall be supplied from a transformer to the heater coil. Ignition shall be considered as occurring when the flame transfers from the escaping gases to the surface of the specimen and continues there, disregarding the flashes which may occur in the gassing space prior to the sustained flame.

4.6.3.2 Time of heating. Heating shall be discontinued 30 seconds after ignition occurs. If ignition does not occur within 600 seconds, the test shall be discontinued.

4.6.3.3 Ignition. Immediately after ignition occurs (see 4.6.3.1), the electrical supply to the spark plugs shall be cut off and the spark plugs shifted away from the flame.

4.6.3.4 Burning time. The number of seconds that the specimen continues to burn, until the cessation of all flaming, after the current in the heater coil has been cut off shall be recorded as the time required for self-extinction.

4.6.4 Test results.

4.6.4.1 Calculation of average ignition time. The average ignition time shall be calculated as the arithmetic mean of the ignition time of the five specimens.

4.6.4.2 Calculation of average burning time. Average burning time shall be calculated as follows. Arrange the five values of the time required for self-extinction in increasing order of magnitude, as T_1 , T_2 , T_3 , T_4 , and T_5 . Compute the following ratios:

$$\frac{T_2 - T_1}{T_5 - T_1} \quad \text{and} \quad \frac{T_5 - T_4}{T_5 - T_1}$$

If either of these ratios exceeds 0.642, then T_1 or T_5 is judged to be abnormal and is eliminated. The average burning time reported shall be the average of the remaining four values. If neither of these ratios exceeds 0.642, the average burning time shall be the average of all five values (see 3.3).

4.7 Test for resin content.

4.7.1 Test specimen. The test specimens shall have a minimum weight of 3 grams and a maximum size of 1 by 1 inch (2.54 by 2.54 cm) by the thickness as supplied (see 4.5). The sides shall be square to the faces and the edges shall not be frayed.

4.7.2 Test apparatus. Test apparatus shall consist of an analytical balance, a desiccator, heat-resistant nonreactive crucibles, and a muffle furnace equipped with temperature controls.

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4.7.3 Test procedure.

4.7.3.1 Weighing of specimen. The specimen shall be weighed on an analytical balance in a previously weighed, ignited crucible.

4.7.3.2 Ignition. The specimen shall be placed in the furnace at a temperature not greater than 650°F (343°C). Temperature of the furnace shall be raised to 1050 ± 50°F (565 ± 28°C) at a rate that will not cause blowing or loss of inorganic filler. The specimen and crucible shall be ignited at this maximum temperature to a constant weight (2 to 6 hours depending on the thickness), and allowed to cool in a desiccator. The loss in weight shall be determined by weighing the specimen and crucible as in 4.7.3.1 after cooling.

4.7.4 Calculation of resin content. Resin content shall be calculated as follows (see 3.4).

$$\text{Resin content, percent by weight} = \frac{\text{loss in weight}}{\text{original weight}} \times 100$$

4.8 One-year outdoor weathering. Panels of laminate (see 4.5) shall be exposed to an outdoor environment for 1 year (see 3.5) on a land rack inclined 45 degrees to the horizontal, facing south. The laminate shall be turned over every 15 days. At the end of the weathering period, specimens shall be cut from the laminate, subjected to standard conditions (air temperature 73 ± 2°F (23 ± 1°C) and relative humidity 50 ± 4 percent) for at least 96 hours prior to testing. The panels shall meet the requirements specified in 3.3.

4.9 Inspection of packaging. Sample packages and packs, and the inspection of the preservation, packing and marking for shipment and storage shall be in accordance with the requirements of section 5 and the documents specified therein.

5. PACKAGING

(The packaging requirements specified herein apply only for direct Government acquisition.)

5.1 Packaging requirements. The resin shall be preserved level A, or commercial, packed level A, B, or commercial as specified (see 6.2), and marked in accordance with MIL-R-7575 and shall include bar codes and applicable packaging acquisition options therein as specified (see 6.2).

5.2 Material safety data sheet. A copy of the material safety data sheet shall be attached to the shipping document for each destination (see 3.7).

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. Resins meeting the requirements of this specification are intended for use when a flame-retardant translucent laminate (as fabricated by contact or vacuum bag processes) is desired. The translucency permits visual

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examination by through lighting for detection of internal defects. Halogenation of the resin molecules provide flame resistance characteristics. Resin additives, to improve the flame resistance, are limited by the requirements of 3.6.

6.2 Acquisition requirements. Acquisition documents must specify the following:

- (a) Title, number, and date of this specification.
- (b) Issue of DoDISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.1.1).
- (c) Grade of resin required (see 1.2 and 3.2).
- (d) If test conditions are to be other than as specified (see 4.2.1).
- (e) Quantity of resin required.
- (f) Level of preservation, packing and marking required (see 5.1).

6.3 Consideration of data requirements. The following data requirements should be considered when this specification is applied on a contract. The applicable Data Item Descriptions (DID's) should be reviewed in conjunction with the specific acquisition to ensure that only essential data are requested/provided and that the DID's are tailored to reflect the requirements of the specific acquisition. To ensure correct contractual application of the data requirements, a Contract Data Requirements List (DD Form 1423) must be prepared to obtain the data, except where DoD FAR Supplement 27.475-1 exempts the requirement for a DD Form 1423.

<u>Reference Paragraph</u>	<u>DID Number</u>	<u>DID Title</u>	<u>Suggested Tailoring</u>
4.4	DI-T-5329	Inspection and test reports	----

The above DID's were those cleared as of the date of this specification. The current issue of DoD 5010.12-L, Acquisition Management Systems and Data Requirements Control List (AMSDL), must be researched to ensure that only current, cleared DID's are cited on the DD Form 1423.

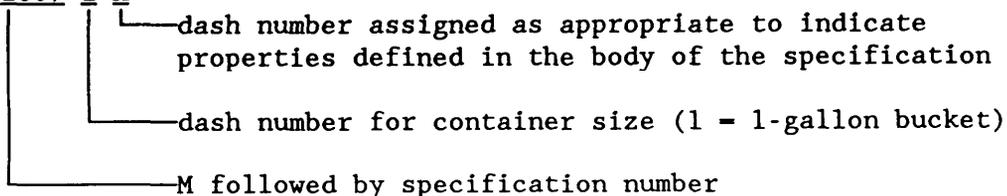
6.4 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract, qualified for inclusion in Qualified Products List No. 21607 whether or not such products have actually been so listed by that date. The attention of the contractors is called to these requirements, 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 purchase orders for the products covered by this specification. The activity responsible for the Qualified Products List is the Naval Sea Systems Command, SEA 5523, Department of the Navy, Washington, DC 20362-5101 and information pertaining to qualification of products may be obtained from that activity. Application for Qualification tests must be made in accordance with "Provisions Governing Qualification SD-6" (see 6.4.1).

6.4.1 Copies of "Provisions Governing Qualification SD-6" may be obtained upon application to Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.

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6.5 Material safety data sheet (MSDS). Contracting officers must identify those activities requiring copies of MSDS's. Additional required Government information is contained in FED-STD-313. In order to obtain the MSDS, FAR clause 52.223-3 must be in the contract.

6.6 Part or Identifying Number (PIN). Resins shall be designated by PINS as identified below:

M21607-1-X

6.7 Subject term (key word) listing.

Flame resistance
 Halogen bonding
 Plastic laminate
 Translucent plastic laminate
 Translucent resin

6.8 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

Preparing activity:
 Navy - SH
 (Project 9330-N006)

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.
2. The submitter of this form must complete blocks 4, 5, 6, and 7.
3. The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

I RECOMMEND A CHANGE:	1. DOCUMENT NUMBER MIL-R-21607E(SH)	2. DOCUMENT DATE (YYMMDD)
3. DOCUMENT TITLE RESINS, POLYESTER, LOW PRESSURE LAMINATING, FIRE-RETARDANT		
4. NATURE OF CHANGE (Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)		
5. REASON FOR RECOMMENDATION		
6. SUBMITTER		
a. NAME (Last, First, Middle Initial)	b. ORGANIZATION	
c. ADDRESS (Include Zip Code)	d. TELEPHONE (Include Area Code) (1) Commercial (2) AUTOVON (If applicable)	7. DATE SUBMITTED (YYMMDD)
8. PREPARING ACTIVITY		
a. NAME Technical Point of Contact (TPOC): Mr. F. Dunham (SEA 05M3) PLEASE ADDRESS ALL CORRESPONDENCE AS FOLLOWS:	b. TELEPHONE (Include Area Code) (1) Commercial (2) AUTOVON TPOC: 703-602-0146	(2) AUTOVON 332-0146
c. ADDRESS (Include Zip Code) Commander, Naval Sea Systems Command Department of the Navy (SEA 5523) Washington, DC 20362-5101	IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT: Defense Quality and Standardization Office 5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466 Telephone (703) 756-2340 AUTOVON 289-2340	

