

METRIC

MIL-PRF-62419A

22 January 1996

SUPERSEDING

MIL-C-62419

29 May 1989

PERFORMANCE SPECIFICATION

COMPOSITE MATERIALS FOR MILITARY VEHICLES

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers commercial plastics for use as a replacement of wood components, such as troop slats, seat racks, stakes, and planks, in military vehicles.

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements documents cited in sections 3 and 4 of this specification, whether or not they are listed.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: U.S. Army Tank-automotive and Armaments Command, ATTN: AMSTA-TR-E/BUE, Warren, MI 48397-5000 by using the Standardization Document Improvement Proposal (DD Form 1426), appearing at the end of this document, or by letter.

AMSC N/A

FSC 2510

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

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2.2 Government documents.

2.2.1 Specifications and standards. 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).

SPECIFICATIONS

FEDERAL

- | | |
|-----------|---|
| VV-F-800 | - Fuel Oil, Diesel. |
| VV-G-1690 | - Gasoline, Automotive, Leaded or Unleaded. |

STANDARDS

FEDERAL

- | | |
|-------------|--|
| FED-STD-595 | - Colors Used in Government Procurement. |
|-------------|--|

(Unless otherwise indicated, copies of the above specifications are available from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the issue of the DoDISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DoDISS are the issues of the documents cited in the solicitation (see 6.2).

AMERICAN SOCIETY FOR QUALITY CONTROL (ASQC)

- ASQC/ANSI Z1.4 - Sampling Procedures and Tables for Inspections by Attributes.

(Copies of ASQC Standards may be obtained from The American Society for Quality Control, P.O. Box 305, 611 E. Wisconsin Ave., Milwaukee, WI 53201-4606.)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- | | |
|-----------|--|
| ASTM D543 | - Resistance of Plastics to Chemical Reagents. |
| ASTM D570 | - Water Absorption of Plastics. |

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ASTM D635	- Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position.
ASTM D695	- Compressive Properties of Rigid Plastics.
ASTM D790	- Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
ASTM D792	- Specific Gravity (Relative Density) and Density of Plastics by Displacement.
ASTM D1505	- Density of Plastics by the Density-Gradient Technique.
ASTM D1894	- Static and Kinetic Coefficients of Friction of Plastic Film and Sheeting.
ASTM D5590	- Fungus Resistance of Paint Films and Coatings.

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

2.4 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 First article. When specified (see 6.2), a first article sample shall be subjected to first article inspection in accordance with 4.2.

3.2 Composite materials and treatments. Components shall be fabricated from suitable composite materials and shall possess properties as specified in 3.4 through 3.5.4. Components shall be available in green color chip 383 of FED-STD-595 when impregnation is required on the drawing. Material shall be available in the lengths, widths and thicknesses specified on the drawing, and shall be capable of being sawn and drilled (see 4.5.1).

3.2.1 Recycled, recovered, or environmentally preferable materials. Recycled, recovered, or environmentally preferable materials should be used to the maximum extent possible provided that the material meets or exceeds the operational and maintenance requirements, and promotes economically advantageous life cycle costs.

3.2.2 Voids. The finished product shall be free from voids (see 4.5.2 and 6.3.1).

3.2.3 Pimples. Pimples shall not exceed 12.7 millimeters (mm) [0.5 inch (in)] in width, 25.4 mm (1 in) in length, and 3.3 mm (0.13 in) in height (see 4.5.2 and 6.3.2).

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3.2.4 Pulled surface. Pulled surfaces shall not exceed 0.9 mm (0.035 in) in width, 76.2 mm (3 in) in length, and 3.3 mm (0.13 in) in height (see 4.5.2 and 6.3.3).

3.2.5 Splits. Splits shall not be greater than 0.9 mm (0.035 in) wide, 6.4 mm (0.25 in) long, and 1.6 mm (0.065 in) deep (see 4.5.2 and 6.3.4).

3.3 Design and construction. The composite components shall conform to the manufacturer's design and construction for composite components except when otherwise specified by applicable drawings and data supplied by the procuring activity (see 4.5.2 and 6.2).

3.4 Physical and mechanical properties for composite components. Physical testing shall be conducted in the unpainted condition, but finished to all other applicable documents.

3.4.1 Specific gravity. Specific gravity shall be not less than 0.5, nor greater than 1.8 (see 4.5.4.1).

3.4.2 Water absorption. Water absorption shall not be greater than 0.8 percent (%) (see 4.5.4.2).

3.4.3 Flexural strength. Flexural strength shall not be less than 37,000 kilopascals (kPa) [5400 pounds per square inch (psi)] (see 4.5.4.3).

3.4.4 Modulus of elasticity. Modulus of elasticity shall be not less than 5,200 megapascals (0.75×10^6 psi), nor greater than 28,000 megapascals (4×10^6 psi) (see 4.5.4.4).

3.4.5 Deflection. Deflection shall not be greater than 1% at 2800 kPa (400 psi), and 10% at 6900 kPa (1000 psi), in the direction of the compressive force exerted by the attaching bolts. If there is no requirement for bolting, deflection shall be measured in the direction of the shortest axis (see 4.5.4.5).

3.4.6 Impact strength. Material shall not split, crack, or shatter under impact of a 3.63 kilogram (kg) (8-pound) ball, 95.3 ± 6.4 mm (3.75 ± 0.25 in) in diameter, dropped from a 3-meter (10 foot) height (see 4.5.4.6).

3.4.7 Coefficient of sliding friction. The coefficient of sliding friction shall be no less than 0.24 (see 4.5.4.7).

3.4.8 Abrasion resistance. After a 30-second blast of medium grit glass at 8.5×10^{-3} cubic meters per second (m^3/s) [18 cubic feet per minute (cfm)], the material shall have no evidence of splintering or cracking (see 4.5.4.8).

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3.4.9 Warp. The maximum warp shall be 4.2 mm per meter of length (0.05 inch per foot of length) (see 4.5.4.9).

3.4.10 Twist. Twist shall not exceed 3.28 degrees per meter of length (1 degree per foot of length) (see 4.5.4.10).

3.5 Environmental.

3.5.1 Extreme temperature. At a temperature of -51 degrees Celsius (°C) [-60 degrees Fahrenheit (°F)], the flexural and strength characteristics of the composite material shall not be reduced by more than 40%. At 71°C (160°F), the impact and flexural strength characteristics shall not be reduced by more than 8% (see 4.5.5.1).

3.5.2 Chemical resistance. After immersion for 1 week in each of the following materials, the composite material shall stay within $\pm 10\%$ of the original weight, and the flexural strength shall not be reduced by more than 10% (see 4.5.5.2).

- a. Lubricating motor oil, internal combustion engine, grades SAE 10W, SAE 30, SAE 40, and SAE 15W40.
- b. VV-G-1690 regular or unleaded gasoline.
- c. Hydrocarbon fuel (combat gasoline), refined, volatile.
- d. Ethylene glycol (undiluted antifreeze), inhibited, heavy duty.
- e. SAE Standard J1703 hydraulic brake fluid.
- f. VV-F-800 diesel fuel.
- g. Methanol at 10%.

3.5.3 Fire resistance. Burning rate of the composite material shall not exceed 25.4 mm (1 in) per minute (see 4.5.5.3).

3.5.4 Fungus. The composite material shall not sustain any fungal growth (see 4.5.5.4).

3.6 Painting. Prior to painting, all foreign matter shall be removed from the surface using an appropriate solvent. The surface shall then be primed using either a water reducible, air-drying, corrosion-inhibiting epoxy-type primer for pretreated metals, or a flash drying, corrosion inhibiting epoxy-type primer for metals. Both types of primer shall be lead and chromate free. The dry film thickness of the coat shall be 0.025 - 0.038 millimeters (mm) (0.001 - 0.0015 in). The surface shall then be topcoated with a chemical agent resistant, single component, aliphatic polyurethane coating with a dry film thickness of not less than 0.046 mm (0.0018 in). The painted surface shall pass an adhesion test (see 4.5.2, 4.5.6, and 4.5.6.1).

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3.7 Workmanship. Workmanship shall be of the quality necessary to produce fabricated composite components free of defects which affect serviceability and appearance (see 4.5.2).

4. VERIFICATION

4.1 Classification of inspection. The inspection conditions specified herein are classified as follows:

- a. First article inspection (see 4.2).
- b. Conformance inspection (see 4.3).

4.2 First article inspection. Unless otherwise specified (see 6.2), first article inspection shall be performed on preproduction or initial production samples as specified when a first article sample is required (see 3.1). This inspection shall include the tests of 4.5.1 through 4.5.6 (see table I) and the examinations of 4.4 (see table II).

TABLE I. Classification of inspection.

Title	Requirement	Inspection	First article	Quality conformance	
				Examination	Control tests
Materials and construction	3.2 and 3.3	4.5.1	X		
Examinations (see table II)	3.2, 3.2.2 thru 3.2.5, 3.3, 3.6, and 3.7	4.5.2	X	X	
Specific gravity	3.4.1	4.5.4.1	X		
Water absorption	3.4.2	4.5.4.2	X		
Flexural strength	3.4.3	4.5.4.3	X		X
Modulus of elasticity	3.4.4	4.5.4.4	X		
Deflection	3.4.5	4.5.4.5	X		
Impact strength	3.4.6	4.5.4.6	X		X
Coefficient of sliding friction	3.4.7	4.5.4.7	X		
Abrasion resistance	3.4.8	4.5.4.8	X		
Warp	3.4.9	4.5.4.9	X		
Twist	3.4.10	4.5.4.10	X		
Extreme temperature	3.5.1	4.5.5.1	X		
Chemical resistance	3.5.2	4.5.5.2	X		
Fire resistance	3.5.3	4.5.5.3	X		X
Fungus resistance	3.5.4	4.5.5.4	X		
Paint adherence	3.6	4.5.6	X		X

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TABLE II. Classification of defects.

Category	Defect	Method of examination
Major 101	Dimensions affecting interchangeability or easy assembly (see 3.3).	SIE 1/
Minor 201	Color (when required), incorrect color, molded in and uniform throughout materials (see 3.2).	Visual
202	Voids, splits, pimples, and pulled surfaces (see 3.2.2 through 3.2.5).	Visual & SIE
203	Appearance, if not the correct surface texture and gloss in the painted condition (see 3.6).	Visual
204	Imperfections, cracks, pits, and inclusion of foreign particles (see 3.7).	Visual

1/ SIE = Standard Inspection Equipment.

4.3 Conformance inspection. Conformance inspection shall include the examinations of 4.4 and the tests of 4.5.4.3, 4.5.4.5, 4.5.5.3, and 4.5.6.

4.4 Examination.

4.4.1 Sampling. Samples from an inspection lot for conformance inspection shall be selected in accordance with ANSI/ASQC Z1.4. Any redesign or modification of the contractor's standard to comply with specified requirements shall receive particular attention for adequacy and suitability. This element of inspection shall encompass all visual examinations and requirements listed in table II. Noncompliance with any specified requirement or presence of one or more defects preventing or lessening maximum efficiency shall constitute cause for rejection.

4.5 Methods of inspection.

4.5.1 Materials. Conformance to 3.2 shall be determined by inspection of contractor records providing proof or certification that materials conform to requirements. Applicable records shall include drawings, specifications, design data, receiving inspection records, processing and quality control standards, vendor catalogs and certifications, industry standards, test reports, and rating data.

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4.5.2 Defects. Conformance to 3.2, 3.2.2 through 3.2.5, 3.3, 3.6 and 3.7, shall be determined by examination of the defects listed in table II. Examination shall be visual, tactile, or by measurement with SIE.

4.5.3 Test conditions. Unless otherwise specified (see 6.2), ambient air temperature shall be $23 \pm 10^{\circ}\text{C}$ ($73 \pm 18^{\circ}\text{F}$), barometric pressure shall be $725 +50 -75$ mm mercury (Hg) ($28.5 +2 -3$ inches Hg), and relative humidity shall be 50 ± 30 percent. Unless otherwise specified herein, testing shall be conducted on surfaces in the unpainted condition, but finished to all other applicable documents.

4.5.4 Performance.

4.5.4.1 Specific gravity. To determine conformance to 3.4.1, specific gravity determination shall be made in accordance with ASTM D792 and ASTM D1505. Three specimens shall be used for this test.

4.5.4.2 Water absorption. To determine conformance to 3.4.2, water absorption determination shall be made in accordance with ASTM D570.

4.5.4.3 Flexural strength. To determine conformance to 3.4.3, flexural strength determination shall be made in accordance with ASTM D790.

4.5.4.4 Modulus of elasticity in bending. To determine conformance to 3.4.4, modulus of elasticity determination shall be made in accordance with ASTM D790.

4.5.4.5 Deflection. To determine conformance to 3.4.5, deflection shall be measured in accordance with ASTM D695.

4.5.4.6 Impact strength test. To determine conformance to 3.4.6, impact strength determination shall be made by employing a 3.63 kg (8 pound) ball, 95.3 ± 6.4 mm (3.75 ± 0.25 in) in diameter, dropped from a vertical height of 3 meters (10 feet) upon a 25 x 76 mm (1 x 3 in) specimen supported on 910 mm (36 in) centers.

4.5.4.7 Coefficient of sliding friction. To determine conformance to 3.4.7, sliding friction determination shall be made in accordance with ASTM D1894.

4.5.4.8 Abrasion resistance. To determine conformance to 3.4.8, abrasion resistance determinations shall be made by employing a 30 second blast of medium grit glass at 8.5×10^{-3} m³/s (18 cfm) from a 6.35 mm (0.25 in) diameter nozzle, 25.4 mm (1 in) from, and perpendicular to the surface.

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4.5.4.9 Warp. To determine conformance to 3.4.9, measure the maximum deviation from a flat plane to the component. This measurement shall be made on all sides of the component.

4.5.4.10 Twist. To determine conformance to 3.4.10, clamp one end of the component to a flat plane. The angle between the plane and the opposite end of the component shall be the degree of twist.

4.5.5 Environmental.

4.5.5.1 Extreme temperature. To determine conformance to 3.5.1, impact and flexural strength shall conform within the reduced requirements. To assure impact strength at -51°C (-60°F), the test shall be performed as specified in 4.5.3.6, except that the specimen shall be at -51°C (-60°F), and a 2.2 kg (4.8 pound) ball, 76.2 ± 6.4 mm (3.0 ± 0.25 in) in diameter, shall be used in lieu of the 3.63 kg (8 pound) ball. Flexural strength shall be determined as specified in 4.5.4.3 when the specimen is at the proper temperature.

4.5.5.2 Chemical resistance. To determine conformance to 3.5.2, chemical resistance determinations shall be made by immersing the material in specified fluids for one week in accordance with ASTM D543.

4.5.5.3 Fire resistance. To determine conformance to 3.5.3, six specimens shall be tested for fire resistance in accordance with ASTM D635.

4.5.5.4 Fungus resistance. To determine conformance to 3.5.4, fungus resistance shall be tested in accordance with ASTM D5590.

4.5.6 Paint adherence. To determine conformance to 3.6, the paint adherence shall be verified with a scribe tape test (see 4.5.6.1) which will be varied among the following locations:

- a. Directly adjacent to a weld.
- b. On or directly adjacent to a machine cut or sheared edge.
- c. Any mechanically formed surface where lubricants are used.
- d. Paint touch-up areas.

4.5.6.1 Scribe tape test. The following procedure shall be followed for the scribe tape test to determine conformance to 3.6 (all dimensions are approximate):

- a. Scribe four 25.4 mm (1 in) lines completely through the paint finish, 1.6 mm (0.06 in) to 2.4 mm (0.09 in) apart.
- b. Scribe another four 25.4 mm (1 in) lines, 1.6 mm (0.06 in) to 2.4 mm (0.09 in) apart, and 90 degrees to the first set of lines. The resulting pattern shall be 9 squares.

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- c. Press a length of A-A-884, A-A-1830, or any commercially available tape with a minimum adhesion rating of 1300 grams per 25.4 mm (45 ounces per inch) of width firmly over the scribed pattern rubbing out all air pockets.
- d. Wait 10 seconds minimum. Grasp a free end of the tape and at a rapid speed strip it from the painted surface by pulling the tape back upon itself at 180 degrees. The removal of two or more squares of topcoat, topcoat primer, or topcoat primer-pretreatment coating shall be cause for rejection. Removal of overspray does not constitute test failure.
- e. Upon completion of the test, the scribe marks shall be feathered into the adjacent area and touched-up.

5. PACKAGING

5.1 **Packaging.** For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When actual packaging of materiel is to be performed by DoD personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity within the Military Department or Defense Agency, or within the Military Department's System Command. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

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

6.1 **Intended use.** The composite materials covered in this specification are intended to be used as wood substitutes in military vehicle components. Areas of application include seat racks, troop slats, stakes, and planks.

6.2 **Acquisition requirements.** Acquisition documents should 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 2.2.1 and 2.3).
- c. Applicable drawings and data (see 3.3).
- d. If first article samples are not required (see 3.1).
- e. Test conditions if other than as specified (see 4.5.3).
- f. Packaging requirements (see 5.1).

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6.3 Definitions.

6.3.1 Void. In a solid plastic, an unfilled space of such size that it scatters radiant energy such as light. Alternate definition: A cavity unintentionally formed in a cellular material and substantially larger than the characteristic individual cells.

6.3.2 Pimple. An imperfection, a small crater in the surface of the plastic, with its width of approximately the same order of magnitude as its depth.

6.3.3 Pulled surface. Imperfections in the surface of a plastic laminate ranging from a slight breaking or lifting in spots to pronounced separation of its surface from its body.

6.3.4 Splits. Strands or bundles of fiber on a plastic piece which are at or above the surface of a reinforced plastic.

6.4 Subject term (key word) listings.

Bodies, vehicle
 Components, vehicle
 Cargo bodies
 Military vehicle components
 Parts, composite
 Plastic components
 Vehicle components

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

Custodian:

Army - AT
 Air Force - 99

Preparing activity:

Army - AT

(Project 2510-0138)

Review activities:

DLA - CS

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. PSC 2510

I RECOMMEND A CHANGE:

1. DOCUMENT NUMBER
MIL-PRF-62419A

2. DOCUMENT DATE (YYMMDD)
960122

3. DOCUMENT TITLE

Composite Materials for Military Vehicles

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

b. TELEPHONE (Include Area Code)
(1) Commercial
(2) AUTOVON

(810) 574-8745

786-8745

c. ADDRESS (Include Zip Code) Commander
U.S. Army Tank-automotive and Armaments
Command, ATTN: AMSTA-TR-E/BLUE,
Warren, MI 48397-5000

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