MIL-S-62502(AT)
15 December 1987
SUPERSEDING
(see 6.5)

MILITARY SPECIFICATION

SHEET MOLDING COMPOUND; LOW SHRINKAGE

This specification is approved for use within the US Army Tank-Automotive Command, Department of the Army, and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers plastic parts fabricated from high strength low shrinkage sheet molding compound (SMC) (see 6.1).

2. APPLICABLE DOCUMENTS

2.1 Government documents.

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

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

AMSC N/A FSC 9330

STANDARDS
MILITARY

MIL-STD-105	- Sampling Procedures and Tables for Inspection by Attributes.
MIL-STD-130	- Identification Marking of US Military Property.
MIL-STD-810	- Environmental Test Methods and Engineering Guidelines.
MIL-STD-45662	- Calibration Systems Requirements.

(Copies of standards required by the contractors in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting activity.)

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted shall be those listed in the issue of the DODISS specified in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS shall be the issue of the nongovernment documents which is current on the date of the solicitation.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D570	- Water Absorption of Plastics, Test Method for.
ASTM D638	- Tensile Properties of Plastics, Test Method for.
ASTM D790	- Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials (Metric), Test Methods for.

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

(Nongovernment standards and other publications are normally available from the organizations which prepare or which distribute the documents. These documents also may be available in or through libraries or other informational services.)

2.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein (except for associated detail specifications, specification sheets or MS standards), the text of this specification shall take precedence. Nothing in this specification, however, shall supersede applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 First article. Unless otherwise specified (see 6.2), the contractor shall furnish parts which shall be subjected to first article inspection (see 4.4). First article inspection samples, properly marked with identifying information shall be representative of the units to be furnished to the Government. All subsequent parts delivered to the Government shall conform to these samples in all of their pertinent physical and performance attributes.

3.2 Materials. The materials used to fabricate parts furnished under this specification shall be high strength low shrinkage sheet molding compound. The material shall be reinforced with 32.5 ± 2.5 percent (%) by weight glass fiber roving of not less than 23 millimeters (mm) length. The SMC shall be formulated with appropriate types and amounts of additives (see 4.8.1).

3.2.1 Recycled, virgin and reclaimed materials. There are no requirements for the exclusive use of virgin materials. The use of recycled or reclaimed (recovered) materials is acceptable provided that all other requirements of this specification are met (see 6.3.1).

3.3 Design and construction. Parts shall be fabricated in accordance with the applicable drawings (see 4.8.1, 4.8.2 and 6.2).

3.4 Physical and mechanical properties. The physical or mechanical properties of the parts or representative test specimens shall be as specified in table I (see 4.8.3).

TABLE I. Physical and mechanical properties.

Property	Units	Minimum values required	ASTM test methods
Tensile strength at 23°C	MPa	100	D638
Flexural strength at 23°C	MPa	170	D790, procedure A, method 1
Flexural modulus at 23°C (2.5 mm deflection)	MPa	8000	D790, procedure A
Water absorption	%	0.8 maximum	D570

3.5 Cold shock adhesion. The SMC material shall be compatible with vinyl plastisol body sealer (see 4.8.4).

3.6 Temperature effect. The parts shall meet the dimensions and tolerances indicated on the part drawing both before and after exposure to 150 ± 5 degrees Celsius (°C) for 90 minutes. In addition, parts shall not blister or exhibit any other deleterious effects following the exposure (see 4.8.5).

3.7 Environmental.

3.7.1 High temperature. The parts shall withstand exposure to a high temperature of 70 ± 3°C, without evidence of visual degradation or embrittlement (see 4.8.6.1).

3.7.2 Low temperature. The parts shall withstand exposure to a low temperature of -54 ± 3°C, without evidence of visual degradation or embrittlement (see 4.8.6.2).

3.7.3 Humidity. The parts shall withstand exposure to a relative humidity of zero to 100%, without evidence of visual degradation or embrittlement (see 4.8.6.3).

3.8 Finish color. Unless otherwise specified in the applicable drawings, the material shall be integrally colored black (see 4.8.2).

3.9 Identification marking. Unless otherwise specified on the applicable drawing, parts furnished shall be marked in accordance with MIL-STD-130 and shall bear the molder's identification marking in a location that will not impair function or appearance (see 4.8.2).

3.10 Workmanship. Workmanship shall be such that the molded parts must be uniform in color, free of splay marks, excessive flash, porosity, checks, cracks, crazing or other molding defects which may impair the intended functions of the part (see 4.8.2).

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order (see 6.2), the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform or witness any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items must 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 assuring that all products or supplies submitted to the Government for

acceptance comply with all requirements of the contract. Sampling in quality conformance does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to acceptance of defective material.

4.1.2 Inspection equipment. Unless otherwise specified in the contract (see 6.2), the contractor is responsible for the provision and maintenance of all inspection equipment necessary to assure that supplies and services conform to contract requirements. Inspection equipment must be capable of repetitive measurements to an accuracy of 10% of the measurement tolerance. Calibration of inspection equipment shall be in accordance with MIL-STD-45662.

4.2 Classification of inspections:

a. First article inspection (see 4.4).
b. Quality conformance inspections (see 4.5).
   1. Examination (see 4.5.2).
   2. Tests (see 4.5.3).
c. Control tests (see 4.6).

4.3 Inspection conditions. Unless otherwise specified (see 6.2), all inspections shall be conducted under the following conditions:

a. Air temperature 23 ± 10°C
b. Barometric pressure 28.5 + 2.0 inches mercury (Hg)
   - 3.0
c. Relative humidity 50 ± 30%

4.4 First article inspection. Unless otherwise specified (see 6.2), first article inspection shall be performed. The Government shall specify the number of parts that shall be subjected to first article inspection (see 6.2). First article samples shall be inspected as specified in table II. Approval of the first article samples by the Government shall not relieve the contractor of his obligation to supply parts that are fully representative of those inspected as a first article sample. Any changes or deviation of the production units from the first article samples shall be subject to the approval of the contracting officer.

TABLE II. Classification of inspections.

Title	Requirement	Inspection	First article	Quality conformance		
				Examination	Tests 1/	Control
Materials and construction	3.2 and 3.3	4.8.1	X			
Defects (see table III)	3.3, 3.8, 3.9 and 3.10	4.8.2	X	X		
Physical and mechanical properties	3.4	4.8.3	X			X
Cold shock adhesion	3.5	4.8.4	X			X
Temperature effect	3.6	4.8.5	X			X
Environmental	3.7	4.8.6	X			

1/ Not applicable

4.4.1 First article inspection failure. Deficiencies found during, or as a result of, first article inspection shall be cause for rejection of the first article sample until evidence has been provided by the contractor that corrective action has been taken to eliminate the deficiency. Any deficiency found during, or as a result of, first article inspection, shall be evidence that all items already produced prior to completion of the first article inspection are similarly deficient unless contrary evidence satisfactory to the contracting officer is furnished by the contractor. Such deficiencies on all items shall be corrected by the contractor. The Government will not accept products until first article inspection is completed to the satisfaction of the Government.

4.5 Quality conformance inspections.

4.5.1 Sampling.

4.5.1.1 Lot formation. Unless otherwise specified (see 6.2), an inspection lot shall consist of all the parts of one type and part number, from an identifiable production period, from one manufacturer, submitted at one time for acceptance.

4.5.1.2 Sampling for examination. Samples for quality conformance examination shall be selected in accordance with general inspection level II of MIL-STD-105.

4.5.2 Examination.

4.5.2.1 Acceptable quality level. Each sample selected in accordance with 4.5.1.2 shall be examined to determine conformance to the following acceptable quality levels (AQL).

Classification	AQL
Major	1.0
Minor	2.5

4.5.2.2 Classification of defects. For examination purposes, defects shall be classified as listed in table III.

TABLE III. Classification of defects.

Category	Defect	Method of examination
Critical	None	
Major	AQL 1.0% Defective	
101	Dimensions affecting interchangeability, out of tolerance (see 3.3).	SIE 1/
102	Identification marking, improper (see 3.9).	Visual
103	Faulty workmanship affecting performance (see 3.10).	Visual
Minor	AQL 2.5% Defective	
201	Dimensions not affecting interchangeability, out of tolerance (see 3.3).	SIE
202	Finish, improper (see 3.8).	Visual
203	Faulty workmanship affecting appearance (see 3.10).	Visual

1/ SIE = Standard Inspection Equipment.

4.5.3 Test. Not applicable.

4.6 Control tests. Unless otherwise specified (see 6.2), control tests shall be conducted on one part from every 200 parts consecutively produced, except that not more than one test shall be performed in a 3 month period, nor less than one test in a 6 month period. Parts shall be subjected to the tests specified in table II.

4.7 Failure. Failure of any part to pass any of the specified quality conformance or control tests shall be cause for the Government to refuse acceptance of the production quantity represented, until action taken by the contractor to correct defects and prevent recurrence has been approved by the Government.

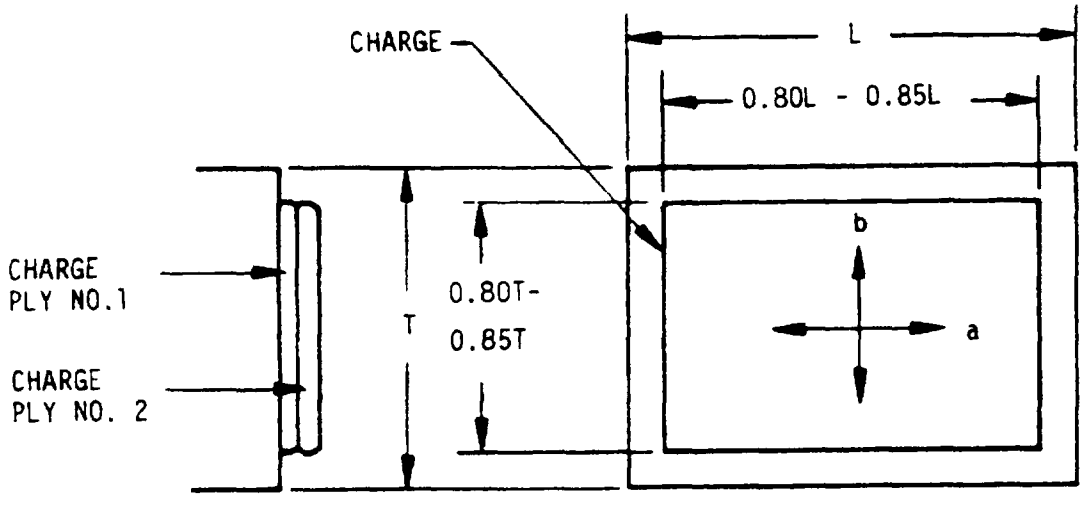
4.8 Methods of inspection.

4.8.1 Materials and construction. Conformance to 3.2 and 3.3 shall be determined by inspection of contractor records providing proof or certification that design, construction, processing, and 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.

4.8.2 Defects. Conformance to 3.3, 3.8, 3.9 and 3.10 shall be determined by examination for the defects listed in table III. Examination shall be visual, tactile, or by measurement with standard inspection equipment.

4.8.3 Physical and mechanical properties. To determine conformance to 3.4, property values shall be determined on molded test plaques in accordance with the following procedures.

4.8.3.1 Test plaques. The specimen dimensions shall be 13 mm by 80 mm minimum length by 2.5 ± 0.1 mm. The plaques shall be molded using the same cure cycle, mold temperature and mold pressure as is used to mold production parts to this specification. In addition, the charge pattern used to mold the plaques shall conform to the condition shown in figure 1 unless the combination of SMC sheet weight and plaque mold dimensions make this impossible.



L = Longitudinal dimension of the mold
T = Transverse dimension of the mold
a = Longitudinal direction of the SMC (sometimes referred to as the machine direction of the SMC) in charge No. 1.
b = Transverse direction of the SMC in charge No. 2.

FIGURE 1. Charge pattern condition.

4.8.3.2 Specimen quantities. For the strength and flexural modulus properties of table I, six specimens shall be averaged with three from the longitudinal direction and three from the transverse direction.

4.8.3.3 Tensile strength. To determine tensile strength (see table I and ASTM D638), speed B (5 mm per minute) and type I specimens shall be used.

4.8.3.4 Flexural strength. To determine flexural strength (see table I) a speed of 1.3 mm per minute and a span of 50 mm shall be used as specified.

4.8.3.5 Flexural modulus. A secant modulus at 2.5 mm deflection shall be measured using procedures of 4.8.3.4.

4.8.4 Cold shock adhesion. To determine conformance to 3.5, the material shall pass the following cold shock adhesion test:

a. Three beads 1.5 to 3.0 mm thick by 6.5 to 9.5 mm long of protective treatment compound E558 plastisol shall be extruded onto the central surface of an SMC test panel that is 250 mm long by 250 mm wide by 2.5 $\pm$ 0.1 mm thick. The surface of the test panel shall be in the as molded condition.

b. The surface shall not be scuff sanded or cleaned prior to application of the plastisol. The plastisol coated test panel shall be baked for 30 minutes in an air circulating oven at 120°C. This panel shall be tested at -30°C using two 4.0 Newton-meter (Nm) impacts. There shall be no loss of adhesion when tested initially or after heat aging for 14 days at 70°C.

4.8.5 Temperature effect. To determine conformance to 3.6, the test plaque shall be exposed to 150 $\pm$ 5°C for 90 minutes. The plaque then shall be measured for dimensions and tolerances. Plaque also shall be visually examined for blisters or any other deleterious effects following the exposure.

4.8.6 Environmental.

4.8.6.1 High temperature. To determine conformance to 3.7.1, the parts shall be subjected to the high temperature test of MIL-STD-810, method 501, procedure I.

4.8.6.2 Low temperature. To determine conformance to 3.7.2, the parts shall be subjected to the low temperature test of MIL-STD-810, method 502, procedure I.

4.8.6.3 Humidity. To determine conformance to 3.7.3, the parts shall be subjected to the humidity test of MIL-STD-810, method 507, procedure III.

5. PACKAGING

5.1 Preservation, packaging, packing, and marking. Preservation, packaging, packing, and marking for the desired level shall be in accordance with the applicable packaging requirements specified by the contracting authority (see 6.2).

6. NOTES

6.1 Intended use. Dimensionally accurate parts molded from low shrinkage SMC material are provided under this specification for use in military equipment.

6.2 Ordering data. Acquisition documents should specify the following:

a. Title, number, and date of this specification.
b. Applicable drawing number, title and date (see 3.3).
c. If first article samples are required (see 3.1).
d. If responsibility for inspection shall be other than as specified (see 4.1).
e. If responsibility for inspection equipment shall be other than as specified (see 4.1.2).
f. If inspection conditions shall be other than as specified (see 4.3).
g. If first article inspection is not required (see 4.4).
h. Number of parts to be submitted for first article inspection (see 4.4).
i. If the number of lot samples shall be other than as specified (see 4.5.1.1).
j. If control testing is not required (see 4.6).
k. Selection of applicable level and packaging requirements (see 5.1).

6.3 Definitions.

6.3.1 Recovered materials. "Recovered materials" means materials that have been collected or recovered from solid waste (see 6.3.2).

6.3.2 Solid waste. "Solid waste" means (a) any garbage, refuse, or sludge from a waste treatment plant, water supply treatment plant, or air pollution control facility; and (b) other discarded material, including solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations, and from community activities. It does not include solid or dissolved material in domestic sewage, or solid or dissolved material in irrigation return flows or industrial discharges which are point sources subject to permits under section 402 of the Clean Water Act, (33 U.S.C. 1342 et seq.), or source, special nuclear, or byproduct material as defined by the Atomic Energy Act of 1954 (42 U.S.C. 2011 et seq.) (Source: Federal Acquisition Regulations, section 23.402).

6.4 Subject term (key word) listing.

Compound, sheet molding, low shrinkage
Low shrinkage, sheet molding compound
Plastic compound, sheet molding, low shrinkage

6.5 Supersession data. This military specification supersedes AM General specification, AMG 157, Revision C, dated 25 January 1985.

Custodian:
Army - AT

Preparing activity:
Army - AT

(Project 9330-A007)

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