

INCH-POUND

MIL-DTL-45301E

5 June 1998

SUPERSEDING

MIL-T-45301D

22 June 1987

## DETAIL SPECIFICATION

### TREAD ELASTOMER: SOLID TIRE, FOR TRACK LAYING 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 6 classes of unvulcanized tread elastomer used in the rebuilding of roadwheels and track support rollers for track laying vehicles.

1.2 Classification. Tread elastomer will be classified as follows:

Class 1 - Piece (cut to length).

Class 2 - Roll (cut to length).

Class 3 - Sheet.

Class 4 - Unmixed sheets (two part batch).

Class 5 - Strip form (for cold feed extruder and injection molding).

Class 6 - Black master batch with separate unmixed chemicals (for mill mixing).

Group A - Physical properties - Standard tensile.

Group B - Physical properties - High tensile.

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/BLUE, 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 2640

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

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## 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 requirement documents cited in section 3 and 4 of this specification, whether or not they are listed.

2.2 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 the documents not listed in the DoDISS are the issues of the documents cited in the solicitation (see 6.2).

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D297	- Rubber Products - Chemical Analysis (DoD Adopted).
ASTM D412	- Rubber Properties in Tension (DoD Adopted).
ASTM D518	- Rubber Deterioration - Surface Cracking (DoD Adopted).
ASTM D573	- Rubber Deterioration in an Air Oven (DoD Adopted).
ASTM D792	- Specific Gravity and Density of Plastics by Displacement (DoD Adopted).
ASTM D1149	- Rubber Deterioration - Surface Ozone Cracking in a Chamber (Flat Specimen) (DoD Adopted).
ASTM D1415	- Rubber Property, International Hardness (DoD Adopted).
ASTM D1646	- Rubber - Viscosity and Vulcanization Characteristics (Mooney Viscometer) (DoD Adopted).
ASTM D2137	- Standard Test Method for Rubber Property - Brittleness Point of Flexible Polymers and Coating Fabrics (DoD Adopted).
ASTM D2240	- Rubber Property - Durometer Hardness (DoD Adopted).
ASTM D3182	- Rubber Materials, Equipment and Procedures for Mixing Standard Compounds and Preparing Standard Vulcanized Sheets (DoD Adopted).
ASTM D3183	- Standard Practice for Rubber - Preparation of Pieces for Test Purposes from Products (DoD Adopted).

(Application for copies should be addressed to the American Society for Testing Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.)

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2.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein, the text of this specification 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 sample shall be subjected to first article inspection in accordance with 4.1.2.

#### 3.2 Material.

3.2.1 Tread elastomer. The chemical compounding of tread elastomer shall be such that all classes and sizes of both groups are black in color. When Group B, P-12 material is furnished, the compound formulation is in accordance with table I (see 4.6.1).

TABLE I. Compound formulation Group B, P 12 material.

Materials	Relative weight	Chemical composition
SBR 1500	70.00	Polymer
Cis-4 1203 or CB 220 <u>1/</u>	30.00	Polymer
Zinc oxide	3.00	
Stearic acid	2.00	
N220 carbon black	62.00	
Flexzone 7-L <u>1/</u>	3.00	(N-1, 3-Dimethybutyl-N'-phenyl-p-phenylenediamine)
Sunolite 100 <u>1/</u>	1.50	(Blend of Waxy Hydrocarbons)
Agerite Resin D <u>1/</u>	2.00	(Polymerized 2, 2,4-trimethyl-1, 2-dihydroquinoline)
Sundex 790 <u>1/</u>	2.00	Oil
Nobs special <u>1/</u>	1.20	[N-oxydiethylene-2-benzothiazole-sulfenamide (2-morpholinothio) benzothiazole]
Santogard PVI <u>1/</u>	0.20	[N-(cyclohexylthio) phthalimide]
Sulfur	1.60	
178.50		
Total Formula Weight		

1/ Substitution may be made with chemical equivalents from other manufacturers.

3.2.2 Tie gum. When specified (see 6.2), tie gum shall be elastomer. Tie gum shall not include any reclaimed rubber (see 4.6.2).

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3.2.3 Backing. Backing shall be made in conformance to the physical properties in table I and may be either flat or embossed (see 4.6.2).

3.2.4 Vulcanization. The vulcanization time in the creation of specimens shall not exceed 90 minutes at a temperature of 280 degrees Fahrenheit (°F) [137 degrees Celsius (°C)]. Processing instructions and recommended curing time and temperature shall be furnished for class 3, 4, 5, and 6 tread elastomer (see 4.6.3 and 6.2).

3.2.5 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.

### 3.3 Construction.

3.3.1 Class 1 and class 2. Unless otherwise specified (see 6.2), class 1 and class 2 tread elastomer shall be supplied with a 0.003 inch (in.) [0.076 millimeter (mm)] minimum layer of plastic sheet backing (see 3.2.3) on the tread surface with the greatest dimension. When tie gum is specified (see 6.2), the tread elastomer shall be an assembly consisting of a layer of tread compound (see 3.2.1), a 0.031 in. (0.787 mm) minimum layer of tie gum on the tread surface with the greatest dimension (see 3.2.2), and a 0.003 in. (0.076 mm) minimum layer of a plastic sheet backing on the tie gum (see 3.2.3). The bonding of these materials shall be such that they will not separate during shipping, normal handling, and processing, including vulcanizing of the tread and tie gum, if applicable, to the wheels. The bond between the tie gum and tread elastomer must be not less than 5 pounds per inch [875.6 Newtons per meter (N/m)] of width. Removal or separation of the plastic backing shall not result in separation of the tie gum from the tread (see 4.7.1).

3.3.2 Class 3, class 4, class 5, and class 6. Unless otherwise specified (see 6.2), classes 3, 4, 5, and 6 tread elastomer shall be furnished with an anti-stick material either applied to the elastomer or inserted between the elastomer sheets. This anti-stick material, a coating intended to be blended into the tread elastomer when milled and extruded, shall not produce any deleterious changes in the physical properties or performance of the cured tread elastomer. Tread elastomer shall be capable of being milled and extruded to the required die sizes and cured to meet the requirements of this specification (see 4.7.2).

3.3.3 Class 4. Class 4 tread elastomer shall be furnished in two unmixed sheets (sheet 1 and sheet 2) with the reactive agents separated. The two sheets shall be sized so that equal lengths of sheet, when properly mixed, extruded and cured, shall provide a tread elastomer

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that meets all of the requirements of this specification. Adequate marking shall be provided to alert processing personnel as to proper ratios and identity. Identification and instructions shall include directions for mixing equal lengths of sheet 1 and sheet 2. The contractor's recommended temperature, curing time and processing instruction shall be included (see 4.7.3).

3.3.4 Class 6. Class 6 tread elastomer shall be furnished as masterbatch blocks or presized sheets of elastomer with the curing agents and chemical additives packaged in premeasured quantities. The masterbatch elastomer, when processed to the contractor's recommended procedure and with the ingredients supplied, shall provide a tread elastomer that meets all of the requirements of this specification (see 4.7.4).

### 3.4 Classes and sizes.

3.4.1 Class 1. Unless otherwise specified (see 6.2), die size and length shall be as specified in table II, and the tread elastomer shall be cut as shown in figure 1 (see 4.8).

TABLE II. Classes and sizes. 2/

Die size 1/	Class	Group	Minimum length in. [meters (m)]	Applicable tire size
50-50-16	2	A	600 (15.24)	9 x 6
30-30-16	2	A	600 (15.24)	10 x 3
50-50-16	1	A	70 (1.78)	10 x 5
36-36-16	1	A	70 (1.78)	11 x 3
36-36-28	1	A	70 (1.78)	12 x 3
42-42-32	2	A	600 (15.24)	12 x 4-1/8
26-26-26	2	A	600 (15.24)	13-7/16 x 1-11/16
40-40-24	1	A	86 (2.18)	13-1/2 x 3-1/2
40-40-24	1	A	86 (2.18)	13-1/2 x 3-3/4
16-26-48	1	A	58 (1.47)	18 x 2-1/2 (x 3-3/4)
62-62-48	1	A	65 (1.65)	20 x 6 x 16
65-65-60	1	A	70 (1.78)	20-1/2 x 6-1/4
26-26-28	1	A	70 (1.78)	22 x 1-11/16 (was 22 x 2)
22-22-24	1	B	70 (1.78)	22 x 1-3/4
62-62-52	1	A	70 (1.78)	22 x 6-1/4
32-32-22	1	A	70 (1.78)	23 x 1-1/4
36-36-30	1	B	79 (2.01)	24 x 2.12 (wide) (AL)
34-34-30	1	B	79 (2.01)	24 x 2-1/8
36-36-30	1	B	79 (2.01)	24 x 2.38 (steel)
47-47-42	1	A	79 (2.01)	24 x 3-3/4 (was 24 x 5)

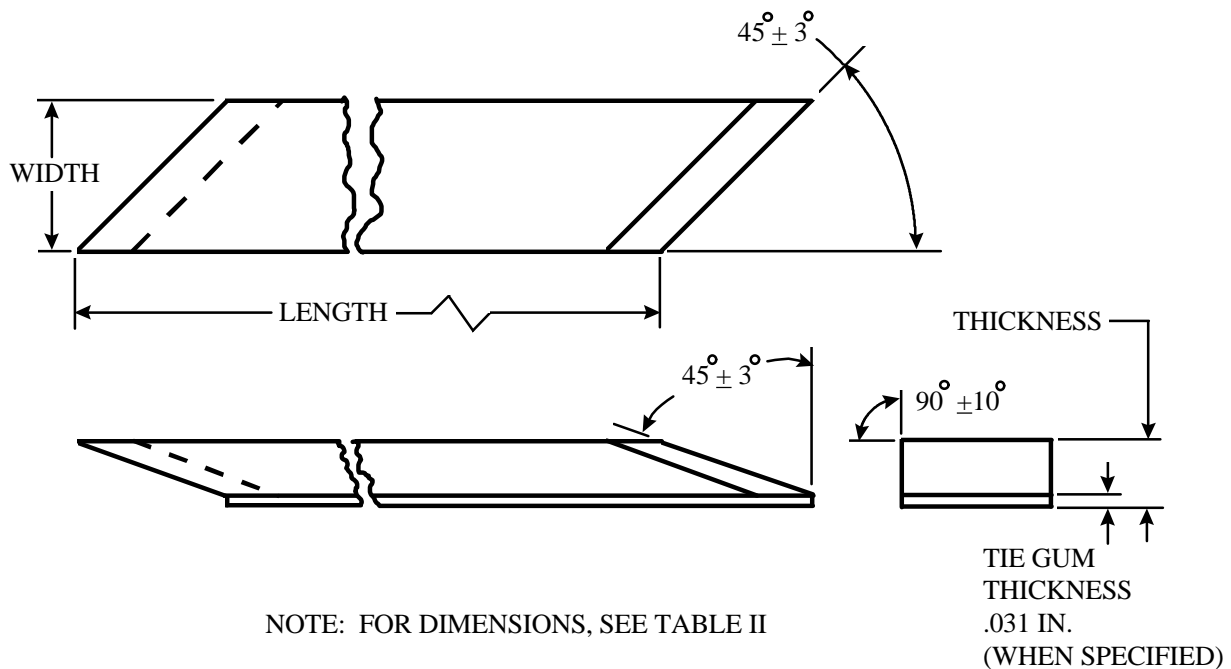
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TABLE II. Classes and sizes 2/ - Continued.

Die size <u>1/</u>	Class	Group	Minimum length in. [meters (m)]	Applicable tire size
42-42-48	1	A	81 (2.06)	25-1/2 x 4-1/2
60-64-48	1	A	81 (2.06)	25 x 5.59
45-45-42	1	A	84 (2.13)	26 x 4-1/2
56-64-44	1	A	84 (2.13)	26 x 5-3/4
64-64-46	1	A	84 (2.13)	26 x 6
36-36-28	1	A	91 (2.31)	28 x 2-3/4
42-42-48	1	A	93 (2.36)	28 x 4-1/2
42-42-36	1	A	110 (2.79)	32-1/4 x 3-1/2

1/ The die size signifies the crown width, in in. and eighths, base width, in in. and eighths, and thickness in thirty-seconds of an in. For example: 45-45-42 indicates 4-5/8 in. crown, 4-5/8 in. base width, and 42/32 in. (1-10/32 in.) thickness. Tolerance on width shall be -0, +1/8 in.; and on thickness shall be -0, +2/32 in.

2/ See 6.3 for corresponding Army drawing numbers for wheels.

FIGURE 1. Tread rubber.

3.4.2 Class 2. Unless otherwise specified (see 6.2), die size and length shall be as specified in table II (see 4.8).

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3.4.3 Class 3. Unless otherwise specified (see 6.2), the tread elastomer shall be furnished in sheet form,  $16.00 \pm 2.00$  in. ( $406 \pm 50$  mm) wide,  $0.38 \pm 0.13$  in. ( $9.6 \pm 3$  mm) thick and  $60.00 \pm 12.00$  in. ( $1524 \pm 305$  mm) in length (see 4.8).

3.4.4 Class 4. Tread elastomer shall be furnished in sheet form as two sheets (sheet 1 and sheet 2) whose relative cross sectional areas shall be regulated by the manufacturer so that equal lengths may be mixed and successfully processed. Sheets shall be 18 in. (457 mm) wide, 0.50 in. (13 mm) thick and 72 in. (1829 mm) in length (see 4.8).

3.4.5 Class 5. Tread elastomer shall be furnished in strip form,  $0.44 +0.03, -0.00$  in. ( $11.1 +0.8, -0.0$  mm) thick by  $2.75 +0.13, -0.00$  in. ( $70 +3, -0.0$  mm) wide suitable for use in a cold feed extruder and injection molding (see 4.8).

3.4.6 Class 6. The masterbatch tread elastomer shall be furnished in preweighed or presized blocks or sheets of elastomer with the curing agents and chemical additives packaged in premeasured quantities sufficient for mixing on a 42 in. (1067 mm) elastomer mill at one time (see 4.8).

### 3.5 Operating requirements.

#### 3.5.1 Performance.

3.5.2 Physical properties. The physical properties of the tread elastomer and the tie gum shall be as specified in table III for all groups. Curing characteristics shall be as specified in table IV. Special physical properties are specified for group B elastomer when furnished in the P-12 material (see 4.9.1.1).

3.5.3 Adhesion. The tread elastomer shall be such that, when vulcanized onto the wheel with the user's approved bonding agent and processes, the adhesion of the tire shall be complete. There shall be no areas of deficient adhesion. The load required to separate the tread from a base band or wheel, per in. of width on any line of separation around the circumference, shall be not less than the following when the different materials are used (see 4.9.1.2):

Group A	- 100 pounds (lb) [45 kilograms (kg)]
Group B	- 130 lb (59 kg), 150 lb (68 kg) average
Group B, P-12 material	- 130 lb (59 kg)

3.5.4 Resistance to blowout. When assembled, the roadwheel (tire) shall withstand 6 hours continuous running at 30 miles per hour (mph) [48 kilometers per hour (km/h)] on a rotating steel wheel drum without evidence of cracking, chunking, blowout, separation, blistering,

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contamination, porosity, delamination or lack of adhesion. Any undercutting shall be not in excess of 0.25 in. (6.35 mm) deep (see 4.9.1.3 and 6.6).

TABLE III. Mechanical and physical properties.

Properties	Tie gum and tread elastomer requirements, all classes		
	Group A	Group B	Group B, P-12 material
<u>Before aging</u>			
Hardness (Durometer, Shore A, or IRHD)	$73 \pm 5$	$72 \pm 7$	$73 \pm 5$
Tensile strength min. pounds per square inch (psi) [kiloPascals (kPa)]	2100 (14 480)	3000 (20 685)	2700 (18 620)
Ultimate Elongation, percent	200 minimum	400 minimum	350 minimum
Modulus, 200 percent min. psi (kPa)	1600 (11 030)	-----	-----
Modulus, 300 percent min. psi (kPa)	-----	-----	2000 (13 790)
Modulus, 400 percent min. psi (kPa)	-----	2000 (13 790)	-----
Specific gravity	1.190 max.	1.200 max.	1.170 max.
Ozone resistance	7 day duration	7 day duration	7 day duration
Low temperature flexibility	-40°C (-40°F)	-40°C (-40°F)	-40°C (-40°F)
<u>After accelerated aging</u>			
Tensile strength min. psi (kPa)	-----	-----	2500 (17 240)
Tensile strength change (percent)	$\pm 25$	$\pm 25$	-----
Elongation change (percent)	$\pm 35$	$\pm 35$	-----

TABLE IV. Curing characteristics. 1/

Mooney units	Tread elastomer and tie gum	
	Before aging	After aging 7 days 158°F (70°C)
Initial reading, max. Mooney units	60	100
4 minute reading, max. Mooney units	40	60
Minutes to 5 point rise, maximum	65	65
Minutes to 5 point rise, minimum	35	19

1/ This table covers the curing characteristics of classes 1, 2, 3 and 5 elastomers and tie gum, and classes 4 and 6 after mixing, using the shearing disk viscometer (ASTM D1646), small rotor, 250°F (121°C), for measuring the Mooney viscosity of the applicable elastomers and tie gums. To determine the uniformity of heavy extruded stocks 1 in. (25.4 mm) and above in thickness, Mooney test specimens will be prepared, 0.25 in. (6.4 mm) in thickness and 1.75 in. (44.5 mm) in diameter, from the surface and inner center of the stock. The difference between the Mooney results shall be not more than 10 minutes to the five point rise. Tie gum can be stripped from tread elastomer



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cut from overhanging edges and plied together to prepare Mooney test specimens 0.25 in. (6.4 mm) in thickness and 1.75 in. (44.5 mm) in diameter.

3.5.5 Resistance to separation. When assembled, the roadwheel (tire) shall withstand 48 hours continuous running at 10 mph (16 km/h) on a rotating steel wheel drum without evidence of cracking, chunking, blowout, separation, blistering, contamination, porosity, delamination or lack of adhesion. Any undercutting shall be not in excess of 0.25 in. (6.35 mm) deep (see 4.9.1.4 and 6.6).

3.6 Ownership and support requirements.

3.6.1 Storage life.

3.6.1.1 Classes 1, 2, 3 and 5. Tread elastomer shall be capable of being stored for a minimum period of 6 months after date of manufacture without any evidence of pre-curing, provided storage has complied with all the following conditions (see 4.10.1.1):

- a. The materials have been protected from physical damage during the storage period.
- b. The ambient air temperature during storage has been within the range of 40°F (4°C) to 90°F (32°C).
- c. The average ambient air temperature during storage has not exceeded 70°F (21°C).

3.6.1.2 Classes 4 and 6. Tread elastomer shall show no pre-curing for two years after the date of manufacture when the unmixed sheets or materials are stored in separate containers, protected by suitable material applied by the manufacturer and under normal inside storage conditions (see 4.10.1.2).

3.6.2 Workmanship. Workmanship shall be such as to produce tread elastomer which will be free of foreign materials, cracks, blisters, or folds. Mixing of compound formulation shall be complete and of the best commercial practice to adequately disperse all ingredients of the formula (see 4.10.2).

3.7 Operating environment requirements.

3.7.1 Mooney viscometer samples for accelerated aging for classes 1, 2, 3 and 5 tread elastomer. The unvulcanized tread elastomer shall meet the after aging Mooney requirements specified in table IV (see 4.11.1).

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3.7.2 Accelerated aging for classes 4 and 6 tread elastomer. Separate samples of unmixed classes 4 and 6 tread elastomer shall be oven aged. The samples shall then be mixed and shall meet the after aging Mooney requirements specified in table IV (see 4.11.2).

3.7.3 Ozone resistance. The elastomer materials used in the solid tires shall be resistant to ozone exposure (see 4.11.3).

3.7.4 Low temperature flexibility. The elastomer shall withstand a low temperature range of -40°F (-40°C) (see 4.11.4).

#### 4. VERIFICATION

4.1 Classification of inspection. The inspection requirements specified herein are classified as followed:

- a. First article inspection (see 4.1.2).
- b. Conformance inspections (see 4.1.4).

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

- a. Air temperature  $73 \pm 18^{\circ}\text{F}$  ( $23 \pm 10^{\circ}\text{C}$ )
- b. Relative humidity  $50 \pm 30$  percent
- c. Barometric pressure  $28.5 (+2.0, -4.5)$  in. of mercury (Hg)  
[96 (+7, -15) kilopascals (kPa)]

4.1.2 First article inspection. Unless otherwise specified (see 6.2), first article inspection shall be performed on the quantities of tread elastomers listed below, when a first article sample is required (see 3.1). Unless otherwise specified (see 6.2), these tests (denoted by an asterisk (\*)) in table V shall be conducted by the Government at a place designated by the Government. The contractor may, upon request, witness the tests conducted by the Government.

- a. Class 1: 10 preformed pieces.
- b. Class 2: 3 rolls.
- c. Classes 3, 4, 5, and 6: 360 lb (164 kg).
- d. All classes: Five (5) platen press sheets (see 4.5). If several die sizes of class 1 and class 2 tread elastomer are ordered, unless otherwise specified (see 6.2), die size for tire size 26 x 6 and die size for tire size 26 x 2 1/8 shall be furnished.

This inspection shall include the examinations of 4.1.3.4 and the tests of table V.

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TABLE V. Classification and location of tests.

Title	Requirement	Tests	First article	Acceptance
First article	3.1	4.1.2	X	
Tread elastomer	3.2.1	4.6.1	X	
Tie gum	3.2.2	4.6.2	X	
Backing	3.2.3	4.6.2	X	
Vulcanization	3.2.4	4.6.3	X	
Construction	3.3.1 thru 3.3.4	4.7.1 thru 4.7.4	X	
Classes & sizes	3.4.1 thru 3.4.6	4.8	X	
Physical properties	3.5.1	4.9.1.1		
Hardness	3.5.1	4.9.1.1	X	X
Tensile strength	3.5.1	4.9.1.1	X	X
Elongation	3.5.1	4.9.1.1	X	X
Modulus	3.5.1	4.9.1.1	X	X
Specific gravity	3.5.1	4.9.1.1	X	X
Mooney viscometer before aging	3.5.1	4.9.1.1	X/*	X
Ozone resistance	3.5.1 & 3.7.3	4.9.1.1 & 4.11.3	X	
Low temperature flexibility	3.5.1 & 3.7.4	4.9.1.1 & 4.11.4	X	
Adhesion	3.5.3	4.9.1.2	X/*	
Resistance to blowout	3.5.4	4.9.1.3	*	
Resistance to separation	3.5.5	4.9.1.4	*	
Storage life;				
Classes 1, 2, 3 & 5	3.6.1.1	4.10.1.1	X	
Classes 4 & 6	3.6.1.2	4.10.1.2	X	
Workmanship	3.6.2	4.10.2		
Mooney viscometer;				
Accelerated aging, classes 1, 2, 3 & 5	3.7.1	4.11.1	X/*	
Accelerated aging, classes 4 & 6	3.7.2	4.11.2	X/*	

4.1.3 Conformance inspection.4.1.3.1 Sampling.

4.1.3.2 Lot formation. Unless otherwise specified (see 6.2), a lot shall consist of not more than 300 pieces, 300 rolls, or 5000 lb (2270 kg) from an identifiable production period,

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from one manufacturer, submitted at one time for acceptance. Lot size for class 1 shall be given in pieces, for class 2 shall be given in rolls, for classes 3, 4, 5, and 6 shall be given in pounds.

4.1.3.3 Sampling for examination. Unless otherwise specified (see 6.2), there shall be 50 samples from the lot specified in 4.1.3.2.

4.1.3.4 Classification of defects. For examination purposes, defects shall be classified as shown in table VI.

TABLE VI. Classification of defects.

Categories	Defects	Inspection method
<u>Critical</u>	None	
<u>Major</u>		
101	Tie gum as not specified (see 3.2.2).	Visual
102	Backing, classes 1 and 2, not as specified (see 3.2.3).	Visual
103	Anti-stick material, class 3, 4, 5, and 6, not as specified (see 3.3.2).	Visual
104	Dimensional nonconformance (see 3.4).	Scale
<u>Minor</u>		
201	Poor workmanship (see 3.6.2).	Visual
202	Packaging not as specified (see 5.1).	Visual

4.1.4 Conformance inspection. From each lot which has passed the visual and dimensional characteristics specified in table VI, a representative sample of 5 shall be selected, unless otherwise specified (see 6.2). Conformance inspection shall also include the examinations and tests listed in table V as defined by the contract.

4.2 Order of inspection. Operating environment test shall be performed first, followed by the remaining verifications in any sequence.

4.3 Verification methods. Acceptable verification methods included in this section are visual inspection and measurement, sample tests, full-scale demonstration tests, simulation, modeling, engineering evaluation, component properties analysis, and similar to previously-approved or previously-qualified designs.

4.4 Verification alternatives. The manufacturer may propose alternative test methods, techniques, or equipment, including the application of statistical process control, tool control, or cost effective sampling procedures to verify performance. See the contract for alternatives that replace verification methods required by this specification.

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4.5 Preparation of sheet specimens. Platen press sheets,  $0.080 \pm 0.010$  in. ( $2.03 \pm 0.25$  mm) in thickness and 6 x 6 in. (152 x 152 mm) square, with a cure of 90 minutes at a temperature of 280°F (138°C) shall be used for conducting the physical properties tests specified in 4.9.1.1 and prepared in accordance with ASTM D3182.

4.6 Material.

4.6.1 Tread elastomer. To determine conformance to 3.2.1, compound color shall be verified by visual examination. To confirm that compound formulation for Group B, P-12 material conforms to table I, tests shall be performed accordingly to the methods of ASTM D297.

4.6.2 Tie gum and backing. To determine conformance with 3.2.2 and 3.2.3, the contractor shall certify that the tie gum, if specified, and the backing conforms to the requirements specified herein.

4.6.3 Vulcanization. To determine conformance to 3.2.4, vulcanization time for the creation of specimens and temperature for class 3, 4, 5, and 6 tread elastomer shall be determined by ASTM D3182.

4.7 Construction.

4.7.1 Class 1 and class 2. To determine conformance to 3.3.1, the tie gum and backing shall be verified with measuring and visual testing procedures.

4.7.2 Class 3, class 4, class 5, and class 6. To determine conformance to 3.3.2, the tread elastomer shall be inspected visually.

4.7.3 Class 4. To determine conformance to 3.3.3, class 4 tread elastomer shall be inspected visually.

4.7.4 Class 6. To determine conformance to 3.3.4, class 6 tread elastomer shall be verified visually and with a scale.

4.8 Classes and sizes. To determine conformance to 3.4.1 through 3.4.6, all classes shall be verified with measurement equipment to confirm dimensional sizes.

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4.9 Operating requirements verification.4.9.1 Performance test.

4.9.1.1 Physical properties. To determine conformance to 3.5.2, physical properties specified in table III shall be determined on specimens cut from the platen press sheets specified in 4.6.3. Tests shall be in accordance with ASTM methods as specified in table VII. Curing tests may be substituted with a certification from the contractor that any elastomer failing to meet the requirements of 3.6.1 will be replaced at no cost to the Government.

TABLE VII. Test methods for physical properties.

Physical property	Method number
Hardness	ASTM D1415 or ASTM D2240
Tensile strength	ASTM D412
Elongation, ultimate	ASTM D412
Tensile stress, (modulus)	ASTM D412
Accelerated aging of tensile and elongation (air heat test, air heating medium)	ASTM D573
Specific gravity	ASTM D792
Ozone resistance test (resistance to surface cracking of stretched elastomer compounds)	ASTM D518 & ASTM D1149
Low temperature flexibility test	ASTM D2137, Method A
Mooney viscometer test (Viscosity and curing characteristics of elastomer by shearing disk viscometer)	ASTM D1646

4.9.1.2 Adhesion.

4.9.1.2.1 Apparatus. To determine conformance to 3.5.3, a tension testing machine having a power-actuated clamp shall be used to apply and measure the force required to strip the tire from the metal wheel or rim to which it is adhered. The clamp shall travel at a rate of 6 in. (152 mm) per minute. The machine shall be provided with means for accurately measuring the applied tension. A hub and spindle assembly shall be provided for mounting the tire and permitting it to rotate fully about a fixed axis.

4.9.1.2.2 Procedure. The tire shall be prepared for testing by cutting down to the metal wheel or rim circumferentially along its edges on both sides to minimize tearing. The tire shall

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also be cut transversely down to the metal base and separated circumferentially, by hand or by using a knife, for a sufficient distance to permit a firm gripping of this free end of the tire by the power actuated clamp. Solvents shall not be used to facilitate this initial separation or any time during actual stripping. The tire shall be mounted on the hub and spindle assembly and positioned in such a manner that its axis of rotation will remain parallel to the line of separation during testing and that the applied force will be normal to the tangent of the wheel or rim at the line of separation. With the free end of the tire firmly gripped by the machine clamp, the machine clamp shall be started and the tire completely stripped from the metal base. If during the test the tire begins to tear instead of separating wholly from the wheel, or rim, the machine shall be stopped and the tire shall be cut with a knife to the metal base and the test started again. Force measurements shall be taken and observation made throughout the test to determine the actual adhesion value. The ambient air temperature during the test shall be between 70°F (21°C) and 110°F (43°C). Loads to be applied shall be as specified in 3.5.3.

#### 4.9.1.3 Blowout (drum).

4.9.1.3.1 Apparatus. To determine conformance to 3.5.4, the testing apparatus shall consist of a rotating steel wheel drum having a smooth flat-faced rim, against which one or more test tires, individually mounted on hub and spindle assemblies permitting free tire rotation, are radially loaded. The steel drum shall have a diameter of 67.23 in.  $\pm$  0.50 in. (1707  $\pm$  12.7 mm) (1/300 mile circumference) with a rim width providing full support to the tire under the loads specified herein. During the test, the apparatus shall be located in an air space controlled at a temperature of 100  $\pm$  5°F (38  $\pm$  3°C).

4.9.1.3.2 Procedure. The tire shall be mounted on the hub and spindle assembly specified in 4.9.1.3.1, and ground if necessary, to assure a radial runout of not more than 0.031 in. (0.8 mm) total indicator reading. The tire shall be loaded radially against the drum. The drum test load shall be determined by multiplying the value obtained from table VIII by the nominal tire width. The tire shall then be run continuously for 6 hours at 30 mph (48 km/h), under the following load conditions:

<u>Time</u>	<u>Percentage of load as determined above</u>
Two hours	100 percent
Two hours	110 percent
Two hours	120 percent

At the conclusion of the test operation, the tire shall be examined externally and then internally by removal of tire from the metal base and subsequent sectioning of the tire to determine conformance to 3.5.4.

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TABLE VIII. Load application ratings. <sup>1/</sup>

Nominal OD tire size (in.)	Load - lb/in (N/m) of nominal tire width at 10 mph (16 km/h)	Load - lb/in (N/m) of nominal tire width at 30 mph (48 km/h)
9	305 (53 410)	120 (21 015)
10	345 (60 415)	140 (24 515)
11	385 (67 420)	155 (27 145)
12	430 (75 300)	175 (30 645)
13	475 (83 180)	195 (34 150)
13 7/16	475 (83 180)	195 (34 150)
13 ½	495 (86 685)	205 (35 900)
20	790 (138 345)	340 (59 540)
21	840 (148 000)	365 (63 920)
22	885 (155 000)	385 (67 420)
23	935 (163 735)	410 (71 800)
24	985 (172 490)	435 (76 175)
25	1035 (181 245)	455 (79 680)
26	1085 (190 000)	480 (84 055)
27	1135 (198 760)	505 (88 435)
28	1185 (207 515)	530 (92 815)
29	1235 (216 270)	555 (97 190)
30	1285 (225 025)	580 (101 570)
31	1340 (234 660)	605 (105 945)
32	1390 (243 415)	630 (110 325)

<sup>1/</sup> Tire load is found by multiplying the value given in the table by the nominal tire width. Interpolation of table values is allowed.

#### 4.9.1.4 Separation (drum) test.

4.9.1.4.1 Apparatus. To determine conformance to 3.5.5, the testing apparatus shall be the same as that specified in 4.9.1.3.1.

4.9.1.4.2 Procedure. The tire, mounted on a hub and spindle assembly, shall be loaded against the drum (see 4.9.1.3.1) and run continuously for 48 hours at 10 mph (16 km/h) and at 100 percent rated load capacity, as determined from table VIII for 10 mph (16 km/h). At the conclusion of the test operation, the tire shall be examined externally and then internally, by removal from the metal base and subsequent sectioning of the tire, to determine conformance to 3.5.5.



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4.10 Ownership and support requirements verifications.4.10.1 Storage life.

4.10.1.1 Classes 1, 2, 3 and 5. The contractor shall certify that the requirements of 3.6.1.1 can be met after proper processing and a 6 month storage period.

4.10.1.2 Classes 4 and 6. The contractor shall certify that the requirements of 3.6.1.2 can be met after proper processing and a 2-year storage period.

4.10.2 Workmanship. Conformance to 3.6.2 shall be determined by examination in accordance with 4.1.3.4.

4.11 Operating environment requirements verifications.

4.11.1 Accelerated aging for classes 1, 2, 3 and 5 tread elastomer. To determine conformance to 3.7.1, unvulcanized tread elastomer shall be subjected to accelerated oven aging for  $166 \pm 2$  hours at  $158 \pm 3^{\circ}\text{F}$  ( $70 \pm 2^{\circ}\text{C}$ ). During the oven aging cycle, the test pieces shall be completely enclosed in cellophane and suspended in the oven. Tests shall be in accordance with ASTM methods specified in table VII.

4.11.2 Accelerated aging tests for classes 4 and 6 elastomer. To determine conformance to 3.7.2, tread rubber elastomer shall be subjected to accelerated oven aging for  $166 \pm 2$  hours at  $158 \pm 3^{\circ}\text{F}$  ( $70 \pm 2^{\circ}\text{C}$ ). After oven aging, the samples shall be mixed and tested in accordance with ASTM methods specified in table VII.

4.11.3 Ozone resistance test.

4.11.3.1 Specimens. To determine conformance to 3.5.2 and 3.7.3, the specimen shall be in accordance with procedure B of ASTM D518 and shall be prepared from tread elastomer, be finished smoothly, and shall be of uniform thickness in accordance with ASTM D3183, or shall be prepared from ASTM tensile slabs of certified equivalent cure prepared from production molding blanks of tread elastomer in accordance with ASTM D3182.

4.11.3.2 Procedure. To determine conformance to 3.7.3, the specimens shall be tested in accordance with procedure B of ASTM D518, except the length of the clamping strips shall be such as to facilitate placement within the ozone test chamber. Specimens shall be placed in the chamber and exposed for 7 days at a temperature of  $104 \pm 3^{\circ}\text{F}$  ( $40 \pm 2^{\circ}\text{C}$ ) in an air-ozone mixture having an ozone partial pressure of approximately 50 millipascals (mPa) in accordance with

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ASTM D1149. The specimens shall be inspected from a 7-power magnification, after the ozone chamber exposure, and shall not find cracks in the elastomer.

4.11.4 Low temperature flexibility test. To determine conformance to 3.7.4, the specimens shall be subjected to the tests as specified in ASTM D2137, method A. The specimens shall be tested and inspected. In the event of a specimen failing, it shall be cause for rejection.

## 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 which may be helpful, but is not mandatory.)

6.1 Intended use. The tread elastomer covered by this specification is military unique. The military unique tread elastomer is for the replacement of the tread in rebuilding of roadwheels and track support rollers for military track laying vehicles. With its form, fit, and function, the tread elastomer has no commercial applications.

6.2 Acquisition requirements. Acquisition documents must specify the following:

- a. Title, number, and date of this specification.
- b. Issue of Department of Defense Index of Specifications and Standards (DoDISS) to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.2).
- c. When first article sample is required (see 3.1).
- d. When tie gum is required (see 3.2.2).
- e. Processing instructions and recommended curing time and temperature for class 3, 4, 5, and 6 tread elastomer (see 3.2.4).
- f. If classes 1 or 2 tread elastomers will be furnished with backing other than as specified (see 3.3.1).

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- g. If class 1 and class 2 compound layer thickness is other than specified (see 3.3.1).
- h. If classes 3, 4, 5, and 6 tread elastomers will be furnished without anti-stick material (see 3.3.2).
- i. If class 1 elastomer should be cut other than as specified (see 3.4.1).
- j. If class 2 die size and length is other than as specified (see 3.4.2).
- k. If class 3 tread elastomer is other than in sheet form as specified (see 3.4.3).
- l. If the inspection conditions are other than as specified (see 4.1.1).
- m. If first article inspection is other than as specified (see 4.1.2).
- n. If the testing location of the elastomer is other than as specified (see 4.1.2).
- o. If testing of class 1 and class 2 dies are other than as specified (see 4.1.2).
- p. If lot formation is other than as specified (see 4.1.3.2).
- q. If the sampling for examination is other than as specified (see 4.1.3.3).
- r. If conformance inspection is other than as specified (see 4.1.4)
- s. Packaging requirements (see 5.1).

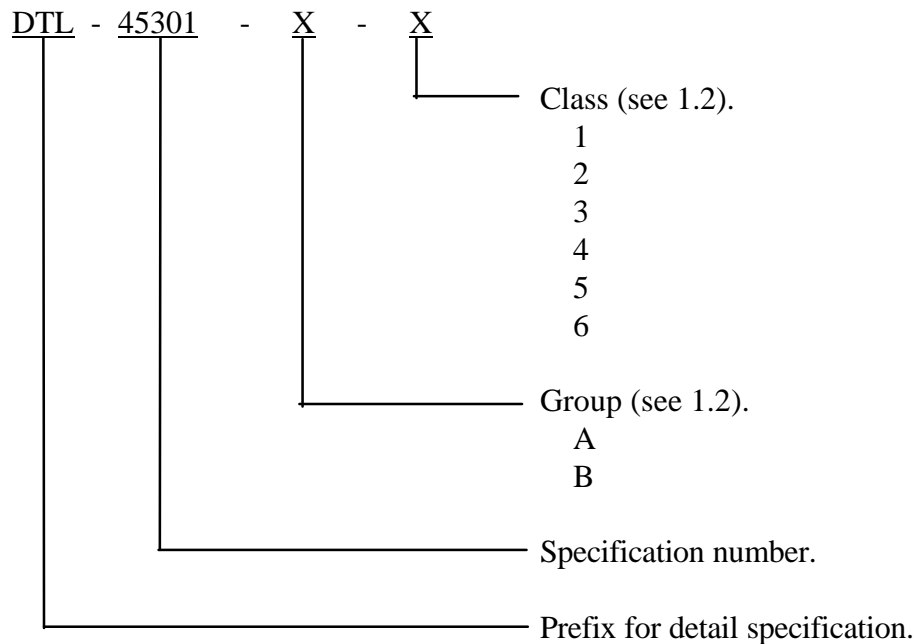
6.3 Wheel application. The tire size and corresponding Army drawing numbers for wheels are:

Tire size	Army drawing number
9 x 6	5638473
10 x 3	5621440
10 x 5	5635856
11 x 3	5636637
12 x 3	8674928
12 x 4-1/8	6548131
13-7/16 x 1-11/16	10891645
13-1/2 x 3-1/2	8763030
13-1/2 x 3-3/4	8706067
	5635849
18 x 2-1/2 (x 3-3/4)	10866037
20 x 6 x 16	5607928
20-1/2 x 6-1/4	5635844
22 x 1-11/16	10891655
(was 22 x 2)	
22 x 1-3/4	10925778
	10954177
22 x 6-1/4	5635861
23 x 1-1/4	9092158
24 x 2.12 (wide) (AL)	11678270 & 12269415
24 x 2-1/8	8763350

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Tire size - Continued.	Army drawing number
24 x 2.38 (steel)	12313083
24 x 3-3/4	10919004
(was 24 x 5)	11636140
25-1/2 x 4-1/2	6576489
25 x 5.59	12274482
26 x 4-1/2	5621441
26 x 5-3/4	10887252
	8762739
26 x 6	7013976
28 x 2-3/4	10954693
28 x 4-1/2	7764921
32-1/4 x 3-1/2	10891631

6.4 Part or Identification Number (PIN). The PIN to be used for tread elastomers acquired to this specification are created as follows:



6.5 Adequacy of physical property requirements. This specification is not intended to be used without conducting the drum tests as specified in 4.9.1.3 and 4.9.1.4. The physical properties specified herein do not fully describe all of the tread elastomer characteristics necessary to meet the wheel performance requirements of this specification.

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6.6 Standard testing of resistance to blowout and separation. Historically the testing procedures for resistance to blowout and resistance to separation were used in accordance with MIL-STD-177 - Rubber Products, Terms for Visible Defects of.

6.7 Definitions. Terminology employed in this specification is in accordance with definitions in ASTM D1566.

6.8 Subject term (key word) listing.

Blow out  
Mooney viscometer  
Rubber  
Tie gum  
Wheel

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

Custodians:

Army - AT  
Navy - MC  
Air Force - 99

Preparing Activity:

Army - AT

(Project 2640-0220)

# STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

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### I RECOMMEND A CHANGE:

1. DOCUMENT NUMBER  
MIL-DTL-45301E

2. DOCUMENT DATE (YYMMDD)  
980605

3. DOCUMENT TITLE TREAD ELASTOMER: SOLID TIRE, FOR TRACK LAYING VEHICLES

4. NATURE OF CHANGE (Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)

5. REASON FOR RECOMMENDATION

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