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MILITARY STANDARD
CLASSIFICATION SYSTEM AND TESTS
FOR SOLID ELASTOMERIC MATERIALS

(Symbols and Tests)



FSC 9320

Army Materials and Mechanics Research Center
Watertown, Massachusetts 02172

Classification System and Tests
For Solid Elastomeric Materials

MIL-STD-417A(MR)

1. This limited coordination Military Standard has been prepared by the Army Materials and Mechanics Research Center based upon currently available information, and has been approved by the Army Materiel Command.
2. Recommended corrections, additions, or deletions should be addressed to the Director, Army Materials and Mechanics Research Center, Watertown, Mass. 02172.

FOREWORD

This standard was revised to reference the latest industry test methods and to include metric equivalents.

The rubber materials covered by this standard can be associated with rubber materials classified in ASTM D2000 entitled "Elastomeric Materials for Automotive Applications."

When specifications and drawings referencing materials listed in this standard are updated, they shall be changed to reference ASTM D2000.

MIL-STD-417A(MR)

CONTENTS

1.	SCOPE
1.1	Scope
1.2	Applications
1.3	Classification
2.	REFERENCED DOCUMENTS
2.1	Specifications and standards
2.2	Other publications
3.	DEFINITIONS
3.1	Grades
3.2	Suffixes
3.2.1	Suffix numbers
3.2.2	Suffix letters
4.	GENERAL REQUIREMENTS
4.1	Materials
4.1.1	Type R
4.1.1.1	Class RN
4.1.1.2	Class RS
4.1.2	Type S
4.1.2.1	Class SA
4.1.2.2	Class SB
4.1.2.3	Class SC
4.1.3	Type T
4.1.3.1	Class TA
4.1.3.2	Class TB
4.2	Physical properties
4.3	Commonly used grades
4.4	Basic requirements
4.4.1	Durometer hardness
4.4.2	Tensile strength
4.4.3	Ultimate elongation
4.4.4	Oil aging
4.4.5	Compression set
4.4.6	Heat aging
4.5	Special requirements added by suffix letter
4.5.1	Resistance to heat aging - Suffixes A, A ₁ , A ₄ , A ₆
4.5.2	Compression set - Suffixes B, B ₁ , B ₃ , and B ₇
4.5.3	Resistance to ozone - Suffixes C ₁ and C ₂
4.5.4	Compression deflection - Suffix D
4.5.5	Resistance to oil and fuel aging - Suffixes E ₁ , E ₃ , E ₄ , E ₅

4.5.6	Low temperature brittleness - Suffixes F ₁ , F ₂ , F ₃ , F ₇ , F ₁₃
4.5.7	Resistance to tear - Suffix G
4.5.8	Resistance to flexing - Suffix H
4.5.9	Resistance to abrasion - Suffix J
4.5.10	Adhesion to metal (bonded) - Suffix K ₁
4.5.11	Adhesion to metal (cemented) - Suffix K ₂
4.5.12	Resistance to water - Suffix L
4.5.13	Resistance to flame - Suffix M
4.5.14	Resistance to repeated impact - Suffix N
4.5.15	Resistance to staining of organic finishes - Suffix P
4.5.16	Resilience - Suffix R
4.5.17	Low temperature torsional stiffness - Suffixes S ₁ , S ₂ , S ₁₁
4.5.18	Special requirements - Suffix Z
4.6	Workmanship

5.	DETAIL REQUIREMENTS
5.1	Tests
5.1.1	For basic requirements
5.1.2	Durometer hardness
5.1.3	Tensile strength
5.1.4	Ultimate elongation
5.1.5	Oil aging
5.1.6	Compression set
5.1.7	Heat aging
5.2	Suffix letter requirements
5.3	Acceptance tests

TABLES

Table			
I	Specimen thickness - Degree twist relationship		
II	Testing for suffix letter requirements		
III	Physical requirements - Type R, Class RN		
IV	"	"	Type R, Class RS
V	"	"	Type S, Class SA
VI	"	"	Type S, Class SB
VII	"	"	Type S, Class SC
VIII	"	"	Type T, Class TA
IX	"	"	Type T, Class TB

MILITARY STANDARD

CLASSIFICATION SYSTEM AND TESTS FOR
SOLID ELASTOMERIC MATERIALS

1. SCOPE

1.1 Scope. This standard covers a group of significant symbols identifying performance characteristics of rubber compositions; and, when practicable, test methods for use in determining compliance with the identifying characteristics.

1.2 Applications. This standard shall be used to identify rubber compositions for military applications. Competent technical discrimination shall be applied, prior to issuance of a procurement document designating a particular grade, to insure that compatible suffix combinations have been selected.

1.3 Classification. Rubber compositions shall be of the following types and classes:

Type R - Non-oil-resistant

Class RN - Natural or synthetic natural (Cis 1-4 polyisoprene)
(see table III)

Class RS - Synthetic (see table IV)

Type S - Oil resistant

Class SA - Very low volume swell (see table V)

Class SB - Low volume swell (see table VI)

Class SC - Medium volume swell (see table VII)

Type T - Temperature resistant

Class TA - Low and high temperature resistant (see table VIII)

Class TB - High temperature and oil resistant (see table IX)

2. REFERENCED DOCUMENTS

2.1 The following documents of the issue in effect on date of invitation for bids, form a part of this standard.

MIL-STD-417A(MR)

SPECIFICATIONS

MILITARY

TT-E-529 - Enamel, Alkyd, Semi-Gloss

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

2.2 Other publications. The following documents form a part of this standard. Unless otherwise indicated, the issue in effect on date of invitation for bids shall apply.

American Society for Testing and Materials (ASTM) Standards:

- D 395 - Compression Set of Vulcanized Rubber
- D 412 - Tension Testing of Vulcanized Rubber
- D 429 - Adhesion of Vulcanized Rubber to Metal
- D 471 - Change in Properties of Elastomeric Vulcanizates Resulting from Immersion in Liquids
- D 518 - Surface Cracking Resistance of Stretched Rubber Compounds
- D 531 - Indentation of Rubber by Means of the Pusey and Jones Plastometer
- D 573 - Accelerated Aging of Vulcanized Rubber by the Oven Method
- D 575 - Compression-Deflection Characteristics of Vulcanized Rubber
- D 624 - Tear Resistance of Vulcanized Rubber
- D 813 - Crack Growth of Rubber
- D 832 - Conditioning of Elastomeric Materials for Low-Temperature Testing
- D 865 - Heat Aging of Vulcanized Rubber by Test Tube Method
- D 925 - Diffusion Strain of Rubber and Migration Strain of Vulcanized Rubber in Contact with Organic Finishes
- D 945 - Mechanical Properties of Elastomeric Vulcanizates Under Compressive or Shear Strains by Mechanical Oscillograph
- D 1053 - Low-Temperature of Stiffening of Rubber and Rubber-like Materials by Means of a Torsional Wire Apparatus
- D 1149 - Accelerated Ozone Cracking of Vulcanized Rubber
- D 1229 - Low-Temperature Compression Set of Vulcanized Elastomers
- D 2137 - Low-Temperature Impact Test for Brittleness Determination for Flexible Polymeric Materials or Fabrics Coated Therewith, or Both
- D 2240 - Indentation Hardness of Rubber and Plastics by Means of a Durometer
- D 2228 - Abrasion Resistance of Rubber by the Pico Method

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

3. DEFINITIONS

3.1 Grades. The grades are designated by numbers following the prefix letters (RN, RS, SA etc.) (see tables III through IX). These grade numbers consist of three digits, the first indicating Shore A durometer hardness range. For example, 3 for 30 ± 5 , 4 for 40 ± 5 , etc. The second and third digits indicate the minimum tensile strength. For example, 10 for 1000 psi (7.0 MPa), 15 for 1,500 psi (10.5 MPa), etc.

3.2 Suffixes. It is recognized that basic requirements used mainly to classify compositions do not sufficiently describe some compositions, thus, provision is made for added requirements which are indicated by suitable suffixes to the grade number.

3.2.1 Suffix Numbers. Suffix numbers are used only in those cases where one composition has the same tensile strength requirements as another composition, but the ultimate elongation requirement differs. The suffix number is expressed by a single digit preceded by a hyphen and appended to the grade designation indicating the required elongation. For example, -4 for 400 percent, -7 for 700 percent, etc.

3.2.2 Suffix Letters^{1/}. Suffix letters are added singly or in combination after any grade number to indicate additional requirements for that particular grade (see tables III through IX).

- A - Resistance to heat aging 70 hours at 158°F (70°C)
- A₁ - Resistance to heat aging 70 hours at 212°F (100°C)
- A₄ - Resistance to heat aging 70 hours at 347°F (175°C)
- A₆ - Resistance to heat aging 70 hours at 447°F (230.9°C)
- B - Compression set after 22 hours at 158°F (70°C)
- B₁ - Compression set after 70 hours at 212°F (100°C)
- B₃ - Compression set after 70 hours at 302°F (150°C)
- B₇ - Compression set after low temperature, 22 hours at -67°F (-55°C)
- C₁ - Resistance to ozone at 50 ppm at 100°F (38°C) for 7 days
- C₂ - Resistance to ozone at 50 ppm at 100°F (38°C) for 7 days after oven exposure for 70 hours at 158°F (70°C)
- D - Compression-deflection
- E₁ - Resistance to oil aging, ASTM D 471, ASTM Oil No. 1
- E₃ - Resistance to oil aging, ASTM D 471, ASTM Oil No. 3
- E₄ - Resistance to oil aging, (compounded petroleum oil)
- E₅ - Resistance to fuel aging (ASTM D471, ASTM Fuel B)
- F₁ - Low temperature brittleness at -40°F (-40°C)
- F₂ - Low temperature brittleness at -67°F (-55°C)
- F₃ - Low temperature brittleness at -103°F (-75°C)
- F₇ - Low temperature brittleness - 22 hours at -67°F (-55°C)
- F₁₃ - Low temperature brittleness - 7 days at -103°F (-75°C)
- G - Resistance to tear

^{1/} Subscript numbers are used to indicate different time, temperature and/or other conditions for the same suffix letter. Numbers are not necessarily used in sequence since some are held in reserve for future requirements.

MIL-STD-417A (MR)

- H - Resistance to flexing
- J - Resistance to abrasion
- K₁ - Adhesion to metal with bond made during vulcanization
- K₂ - Adhesion - cemented bonds made after vulcanization
- L - Resistance to water
- M - Resistance to flame
- N - Resistance to repeated impact
- P - Resistance to staining
- R - Resiliency
- S₁ - Low temperature torsional stiffness at -40°F (-40°C)
- S₂ - Low temperature torsional stiffness at -67°F (-55°C)
- S₁₁ - Low temperature torsional stiffness - 7 days at -40°F (-40°C)
- Z - Special requirements

4. GENERAL REQUIREMENTS

4.1 Materials. Rubber compositions specified herein shall be of three types and seven classes. These compositions shall be manufactured from natural rubber, reclaimed rubber, synthetic rubber or rubber-like materials, together with added compounding ingredients of such nature and quality as to produce vulcanized rubber conforming to the requirements of this standard. These vulcanized compositions shall show no objectionable bloom nor bleeding. Unless otherwise specified, color shall be black except for the TA compositions whose color is dependent on the filler used.

4.1.1 Type R. Type R composition shall be made from natural rubber, reclaimed rubber, synthetic rubber or rubber-like materials, alone or in combination, for services where specific resistance to the action of petroleum based fluids is not required.

4.1.1.1 Class RN. Class RN composition shall be based on natural rubber in the form of crude rubber or reclaimed rubber or synthetic natural rubber (Cis 1-4 polyisoprene).

4.1.1.2 Class RS. Class RS composition shall contain synthetic rubber or rubber-like materials for general purpose use where oil resistance is not required.

4.1.2 Type S. Type S compositions shall be made from synthetic rubber or rubber-like materials for services where specific resistance to the action of petroleum base fluids is required.

4.1.2.1 Class SA. Class SA compositions shall have very low volume swell in low-aniline point oils or fuels.

4.1.2.2 Class SB. Class SB compositions shall have low volume swell in low-aniline point oils or fuels.

4.1.2.3 Class SC. Class SC compositions shall have medium volume swell in low-aniline point oils or fuels.

MIL-STD-417A(MR)

4.1.3 Type T. Type T composition shall be made from synthetic rubber or rubber-like materials which shall be suitable for services where specific resistance to the effects of high or low temperatures is required.

4.1.3.1 Class TA. Class TA compositions shall be made from materials having maximum resistance to the effects of both high and low temperatures.

4.1.3.2 Class TB. Class TB compositions shall be made from materials having outstanding resistance to both dry heat and oils at high temperature.

4.2 Physical Properties. The physical properties of rubber compositions shall conform to the values established in tables III through IX as determined by the applicable tests prescribed in 5.1.1 and table II. Physical properties contained in this specification are not applicable to rubber compositions used as a binder for material such as cork to form a uniform and homogeneous material.

4.3 Commonly used grades. The compositions for tables III through VII marked with an asterisk are those most commonly used. It is suggested that these grades be specified when practicable.

4.4 Basic requirements.

4.4.1 Durometer hardness. The durometer hardness of samples tested shall not exceed the limits established in the applicable table when samples are prepared and tested in conformance to 5.1.2.

4.4.2 Tensile strength. Tensile strength of samples tested shall not be below the minimum value established in the applicable table when samples are prepared and tested in conformance to 5.1.3.

4.4.3 Ultimate elongation. Ultimate elongation of samples tested shall not be below the minimum value established in the applicable table when samples are prepared and tested in compliance with 5.1.4.

4.4.4 Oil aging. The changes in physical properties shall not exceed the limits established in the applicable table when samples are prepared and tested in accordance with paragraph 5.1.5.

4.4.5 Compression set. Compression set values shall not exceed the percentages established in the applicable table when the samples are prepared and tested in conformance with 5.1.6.

4.4.6 Heat aging. The change in physical properties shall not exceed the limits established in the applicable table when samples are prepared and tested in conformance to 5.1.7.

4.5 Special requirements added by suffix letter.

4.5.1 Resistance to heat aging. Suffixes A, A₁, A₄, and A₆. Physical properties (durometer hardness, tensile strength, ultimate elongation) shall not exceed the maximum limits established in the applicable table when prepared and tested in conformance to the applicable requirements of table II. The aged specimens shall show no evidence of cracking when bent back 180 degrees upon themselves.

MIL-STD-417A(MR)

4.5.2 Compression set - Suffixes B, B₁, B₃ and B₇. Compression set values shall not exceed percentages established in the applicable table when samples are prepared and tested in conformance to the applicable requirements of table II. For Suffix B₇ (22 hours at -67°F (-55°C)) compression set shall not exceed 70 percent after 30 minutes recovery at -67°F (-55°C).

4.5.3 Resistance to ozone - Suffixes C₁ and C₂. The specimens shall show no evidence of cracking when examined following testing in conformance with the applicable requirements of table II. Compositions that are being tested for conformance to the requirements for C₁ suffix shall show no cracks after exposure to an ozone concentration of 50 parts per hundred million of air. Compositions that are being tested for conformance to the requirements for C₂ suffix shall show no cracks after exposure to an ozone concentration of 50 parts per hundred million of air after oven exposure for 70 hours at 158°F (70°C).

4.5.4 Compression deflection - Suffix D. Compression deflection values shall not exceed the limits established in the RN and RS tables when samples are prepared and tested in conformance with the applicable requirements of table II.

4.5.5 Resistance to oil and fuel aging - Suffixes E₁, E₃, E₄, and E₅. The change in physical properties, following testing in conformance with the applicable requirements of table II, shall not exceed the limits established within the applicable table.

4.5.6 Low temperature brittleness - Suffixes F₁, F₂, F₃, F₇, and F₁₃. There shall be no evidence of any break, crack, fissure or hole visible to the naked eye after testing in conformance with the applicable requirements of table II. Compositions that are being tested for conformance with the requirements of F₁ compounds shall not fail at -40°F (-40°C) while compositions being tested for conformance to the requirements of F₂ and F₇ shall not fail at -67°F (-55°C), and those for F₃ and F₁₃ shall not fail at -103°F (-75°C).

4.5.7 Resistance to tear - Suffix G. Specimens shall be prepared and tested in conformance with the applicable requirements of table II. Unless otherwise specified, the tear resistance shall not be less than 200 pounds per inch (35.02 kN/m) of thickness for compositions having a tensile of 2000 psi (14.0 MPa) or 150 pounds per inch of thickness (26.26 kN/m) if tensile is under 2000 psi (14.0 MPa).

4.5.8 Resistance to flexing - Suffix H. Specimens shall be prepared and tested in conformance with the applicable requirements of table II. It shall be the responsibility of the procuring activity to establish acceptance values for compounds when tested as specified herein.

4.5.9 Resistance to abrasion - Suffix J. Specimens shall be prepared and tested in conformance with the applicable requirements of table II. Unless otherwise specified, the loss in weight of the specimens after testing shall not exceed 5 percent.

MIL-STD-417A(MR)

4.5.10 Adhesion to metal bond made during vulcanization - Suffix K₁. Specimens shall be prepared and tested in conformance with the applicable requirements of table II. Unless otherwise specified, the adhesion value shall not be less than 40 pounds per inch (7.00 kN/m) of width.

4.5.11 Adhesion, cemented bond made after vulcanization - Suffix K₂. It shall be the responsibility of the procuring activity to establish the test method and the adhesion value.

4.5.12 Resistance to water - Suffix L. Specimens shall be prepared and tested in conformance with the applicable requirements of table II. Durometer hardness shall not change more than ± 10 points, and volume shall not increase more than 10 percent for RS and SB compounds only.

4.5.13 Resistance to flame - Suffix M. Specimens shall be prepared and tested in conformance with the applicable requirements of table II. Unless otherwise specified, the flame propagation rate of the specimen shall not exceed 1/2 inch (12.7 mm) per minute, and the specimen shall show no evidence of separation of burning particles.

4.5.14 Resistance to repeated impact - Suffix N. It shall be the responsibility of the procuring activity to establish the test method and the number and magnitude of foot pound blows the specimen must be capable of withstanding.

4.5.15 Resistance to staining of organic finishes - Suffix P. Specimens shall be prepared and tested in conformance with the applicable requirements of table II. The enameled surface shall show no evidence of staining.

4.5.16 Resilience - Suffix R. Specimens shall have a Yertzley resilience of not less than that shown on the applicable table for the grade specified, when tested in conformance with the applicable requirements of table II.

4.5.17 Low temperature torsional stiffness - Suffixes S₁, S₂, and S₁₁. Specimens shall be prepared and tested for conformance with the applicable requirements of table II. Specimens being tested for conformance with the requirements of these suffixes shall meet the minimum twist requirements of table I. Compositions that are being tested for conformance with the requirements for S₁ and S₁₁ compositions shall be tested at -40°F (-40°C) while those being tested for conformance with the requirements for S₂ compositions shall be tested at -67°F (-55°C).

MIL-STD-417A(MR)

Table 1 - Specimen thickness - Degree twist relationship^{1/}

Torsional stiffness test		
Inches	Thickness	
	(mm)	Twist, angular degrees, minimum
.060	1.5	98
.070	1.8	80
.080	2.0	66
.090	2.3	55
.100	2.5	46
.110	2.8	40

^{1/} Interpolation shall be used for those thicknesses not contained within this table. These values are based on a modulus of elasticity of 10,000 psi (70 MPa) for a specimen having a free span length of 1.0 inch (25.4 mm) and 0.125 inch (3.175 mm) wide.

4.5.18 Special requirements - Suffix Z. It shall be the responsibility of the procuring activity to establish a criterion for determining conformance to any special requirements that the procuring activity may require.

4.6 Workmanship. Compositions shall be uniform in construction and appearance and shall be free of porous areas, weak sections, bubbles, foreign matter and other defects affecting serviceability of the finished item.

5. DETAIL REQUIREMENTS

5.1 Tests.

5.1.1 Basic requirements. Testing for conformance with the basic requirements shall be performed in accordance with the following tests in order to determine compliance with the applicable requirements of section 4.

5.1.2 Durometer hardness. Determination shall conform to ASTM D 2240 using a Shore A durometer. ASTM D 531 shall be used as a referee method.

5.1.3 Tensile strength. Determination shall be in conformance with ASTM D 412 using a dumbbell shaped specimen, cut with a die conforming with the dimensions of die C.

5.1.4 Ultimate elongation. Determination shall be in conformance with ASTM D 412 using a dumbbell shaped specimen cut with a die conforming to the dimensions of die C.

5.1.5 Oil aging. Testing shall be done in conformance with ASTM D 471 using ASTM Oil No. 3 as the test fluid. Temperature of oven and duration of test shall be as specified in the applicable table.

MIL-STD-417A(MR)

5.1.6 Compression set. Testing shall be in conformance with ASTM D 395, method B.

5.1.7 Heat aging. Testing shall be in accordance with ASTM D865 for TA compounds. Test specimens shall be cut with a die conforming to die C of ASTM D412.

5.2 Suffix letter requirements. Testing for conformance with suffix letter requirements shall be accomplished in conformance with the applicable requirements of table II, in order to determine compliance with the applicable requirements of section 4.

Table II - Testing for suffix letter requirements

Suffix letter	Test method
A, A ₁ , A ₄ , and A ₆	Use ASTM D 573 at 158 or 212°F (70°C or 100°C) or ASTM D 865 at 250°F (121°C) or over. Test specimens shall be cut with a die conforming to die C of ASTM D 412. Subsequent to testing for change in durometer hardness, tensile strength and ultimate elongation of the aged specimens, one part of the broken specimen shall be bent back upon itself and be held in that position for 30 seconds. Temperature of the oven or tube and duration of the test shall be as specified in the applicable table.
B, B ₁ and B ₃	ASTM D 395, method B
B ₇	ASTM D 1229 - 22 hours at -67°F (-55°C)
C ₁ and C ₂	ASTM D 1149 - Test specimen size shall be 1 inch (25.4 mm) wide, 3-3/4 inches (95.25 mm) long and 0.075 (1.91 mm) to 0.125 (3.175 mm) inch thick. Specimens shall be mounted in accordance with the requirements of ASTM D 518, method B, except that the length of the clamping strips shall be such as to facilitate placement within the test chamber of the ozone cabinet. Duplicate specimens from each composition or item being tested for conformance to this suffix letter shall be tested for conformance to suffix letter C ₁ shall be exposed for 7 days to an ozone concentration of 50 ± 5 parts per hundred million of air at a temperature of 100 ± 2°F (38 ± 1°C). At the end of the exposure time the specimens shall be examined under a seven power magnifier. Samples being tested for conformance with suffix letter C ₂ shall be exposed for 7 days to an ozone concentration of 50 ± 3 parts per hundred million of air at a temperature of 100 ± 2°F (38 ± 1°C) after oven exposure for 70 hours at 158°F (70°C). At the end of the exposure time, the specimen shall be examined under a seven power magnifier.
D	ASTM D 575

MIL-STD-1717A (MRA)

E ₁ , E ₃ , E ₄ , and E ₅	ASTM D471. Specimens that are being tested for conformance with the requirements of Suffix E ₁ shall be tested in ASTM Oil No. 1; those with Suffix E ₃ in ASTM Oil No. 3; those with Suffix E ₄ in ASTM Service Fluid 100; those with Suffix E ₅ in ASTM Reference Fuel B.
F ₁ , F ₂ , F ₃ , F ₇ , & F ₁₃	ASTM D2137, Method A. Five type B specimens shall be tested at one time. Paragraph 9.3.2 of ASTM D2137 shall be used to determine acceptance or failure of compositions tested. Specimens being tested for conformance to Suffix F ₁ requirements shall be conditioned for 3.0 ± 0.5 minutes in liquid at -40° ± 2°F (-40 ± 1°C) and then tested. Specimens being tested for conformance to Suffix F ₂ requirements shall be conditioned for 3.0 ± 0.5 minutes in liquid at -67 ± 2°F (-55 ± 1°C) and then tested. Specimens being tested for conformance to Suffix F ₃ requirements shall be conditioned for 3 minutes in liquid at -103 ± 3°F (-75 ± 2°C) and then tested. Specimens being tested for conformance to Suffix F ₇ requirements shall be conditioned for 22 hours in air at -67 ± 2°F (-55 ± 1°C) and then tested. Specimens being tested for conformance to Suffix F ₁₃ requirements shall be conditioned for 7 days in air at -103 ± 3°F (-75 ± 2°C) and then tested.
G	ASTM D 624 - The specimen shall be cut with a die conforming to die B.
H	ASTM D 813
J	ASTM D 2228
K ₁	ASTM D 429, Method B
K ₂	The procuring activity shall determine the method of testing for conformance to this suffix letter.
L	ASTM D 471
M	<p>The testing apparatus shall consist of (1) a metal chamber, 12 inches (304.8 mm) wide by 14 inches (355 mm) deep by 24 inches (609.6 mm) tall, open at the top and front; (2) a Tirrell burner with a 3/8 inch (9.53 mm) bore and 4 inches (101.6 mm) long above the primary air inlets; (3) a watch or clock with a sweep second hand; and (4) a supply of illuminating gas at normal pressure.</p> <p>The specimens shall be 10 inches (254 mm) long, 1/2 inch (12.7 mm) wide and 1/4 inch (6.35 mm) thick. Not less than three specimens shall be tested. The specimen shall be marked at a distance of 2 inches (50.8 mm) from each end,</p>

	<p>and centered in a horizontal position in the test chamber, on supports 8 inches (203 mm) apart and clamped at each end. The burner shall be adjusted to provide a flame approximately 5 inches (127 mm) high, having an inner blue cone approximately 1.5 inches (38.1 mm) high. The burner shall be placed beneath the specimen midway between the supports in such a manner that the flame of the core just touches the underside of the specimen. The burner shall be left in this position for 30 seconds, then removed and the flame extinguished. The rate of flame travel (total inches divided by time of test) along the 6 inch (152.4 mm) test length shall then be calculated and the average of the three specimens shall be reported as the flame propagation time.</p>
N	<p>The procuring activity shall determine the method of testing for conformance to this suffix letter.</p>
P	<p>ASTM D 925, method B - The metal panels shall be finished with olive drab enamel conforming to Specification TT-E-529 and shall be aged 48 hours prior to the test. Exposure shall be 24 hours at $140 \pm 5^{\circ}\text{F}$ ($60 \pm 3^{\circ}\text{C}$).</p>
R	<p>ASTM D 945, part A</p>
S ₁ , S ₂ , and S ₁₁	<p>ASTM D 1053 - The general procedures of this method shall be used, with the exception of those sections that are in conflict with the following. The angle of specimen twist shall be determined at only one temperature (-40°F) (-40°C) for testing samples for compliance with S₁ or S₁₁ requirements or -67°F (-55°C) for testing samples for compliance with S₂ requirements. Test specimen dimensions shall be as follows: Thickness -- $0.085 \pm .025$ inch (2.16 ± 0.64 mm); free span specimen length -- $1.0 \pm .10$ inch (25.4 ± 2.54 mm); width -- $0.125 \pm .005$ inch (3.175 ± 0.13 mm). Only one wire shall be used for the test. The wire shall be $2.6 \pm .3$ inches (66 ± 7.62 mm) long and have a torsional constant of 0.500 gram-force-centimeter per degrees of twist (color code yellow). For liquid heat transfer media the temperature of the bath surrounding the entire test specimens shall be controlled to within $\pm 1.8^{\circ}\text{F}$ ($\pm 1.0^{\circ}\text{C}$) and the specimen shall be conditioned 5 ± 0.5 minutes. (The liquid heat transfer media and temperature control as described within ASTM D 2137 are suitable.) For gaseous media the temperature of the bath surrounding the entire test specimens shall be controlled to within $\pm 2^{\circ}\text{F}$ ($\pm 1^{\circ}\text{C}$) and specimens shall be conditioned one hour for S₁ or S₂ and 7 days for S₁₁ requirements. Not less than three specimens shall be tested from each sample submitted, for conformance with the twist requirements of table 1. If one of the three specimens tested fails to meet the minimum twist requirements for its thickness, three additional specimens shall be tested. Failure of any one of the second set of specimens shall constitute failure of the sample.</p>

MIL-STD-417A (MR)

Z	See 4.5.18
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5.3 Acceptance tests. The requirements for rejections and retesting shall be established by the procuring activity. It is recognized that deviations by the purchaser may be permitted to the extent of 10 percent tensile and elongation only when test specimens are cut from parts instead of test slabs due to variations in shape factor, grain effect and knitting of the rubber composition.

Custodian:

Army - MR

Preparing Activity:

Army - MR

Review interest:

Army - ML

Project Number 9320-A162

Table III - Physical Requirements of Rubber Compositions - Type R, Class RN

Grade number	Basic Requirements					Requirements Added by Suffix Letter						
	Durometer hardness number	Tensile strength min. psi	Tensile strength min. MPa	Ultimate elongation, min., %	Compression set after 22 hr. at 158 F (70 C) max., %	Suffix A Heat aged 70 hr. at 158 F (70 C)			Suffix B Compression set after 22 hr. at 158 F (70 C) max., %	Suffix D load at 20% deflection psi MPa	Suffix R Yerzley resilience at 20% deformation min., %	
						+10	-20	-30				
RN 310	30 ± 5	1000	7.0	400	50	+10	-20	-30	25	70 ± 10	0.483 ± 0.069	80
RN 315		1500	10.5	500	"	"	"	"	"	"	"	"
RN 320		2000	14.0	600	"	"	"	"	"	"	"	"
RN 325		2500	17.5	600	"	"	"	"	"	"	"	"
RN 410	40 ± 5	1000	7.0	500	"	"	"	"	"	100 ± 15	0.689 ± 0.103	75
RN 415		1500	10.5	500	"	"	"	"	"	"	"	"
RN 420		2000	14.0	500	"	"	"	"	"	"	"	"
RN 425		2500	17.5	600	"	"	"	"	"	"	"	"
RN 430		3000	21.0	600	"	"	"	"	"	"	"	"
RN 510	50 ± 5	1000	7.0	400	"	"	"	"	"	140 ± 20	0.965 ± 0.138	70
RN 515		1500	10.5	400	"	"	"	"	"	"	"	"
RN 520		2000	14.0	500	"	"	"	"	"	"	"	"
RN 525		2500	17.5	500	"	"	"	"	"	"	"	"
RN 530		3000	21.0	600	"	"	"	"	"	"	"	"
RN 535		3500	24.5	600	"	"	"	"	"	"	"	"
RN 610	60 ± 5	1000	7.0	300	"	"	"	"	"	195 ± 30	1.344 ± 0.207	60
RN 615		1500	10.5	350	"	"	"	"	"	"	"	"
RN 620		2000	14.0	400	"	"	"	"	"	"	"	"
RN 625		2500	17.5	450	"	"	"	"	"	"	"	"
RN 630		3000	21.0	450	"	"	"	"	"	"	"	"
RN 635		3500	24.5	500	"	"	"	"	"	"	"	"
RN 710	70 ± 5	1000	7.0	200	"	"	"	"	"	300 ± 70	2.068 ± 0.483	50
RN 715		1500	10.5	250	"	"	"	"	"	"	"	"
RN 720		2000	14.0	300	"	"	"	"	"	"	"	"
RN 725		2500	17.5	300	"	"	"	"	"	"	"	"
RN 810	80 ± 5	1000	7.0	150	"	"	"	"	"	475 ± 100	3.275 ± 0.70	
RN 815		1500	10.5	150	"	"	"	"	"	"	"	"
RN 820		2000	14.0	200	"	"	"	"	"	"	"	"
RN 910	90 ± 5	1000	7.0	100	"	"	"	"	"	"	"	"
RN 915		1500	10.5	150	"	"	"	"	"	"	"	"

*Grades most commonly used.

MIL-STD-417A(M)

Table IV - Physical Requirement of Rubber Compositions - Type R, Class RS

Grade Number	Durometer hardness number	Tensile strength min. psi	Tensile strength min. MPa	Ultimate elongation, %	Compression set after 22 hr. at 158 F (70 C) max., %	Requirements added by suffix letter								
						Suffix A				Suffix B				Suffix D
						Heat aged 70 hrs at 158 F (70 C)		Heat aged 70 hrs at 212 F (100 C)		Hardness change, max.		Tensile change, max.		Elongation change, max.
RS 310	30 ± 5	1000	7.0	400	50	+10	-25	-35	-10	-25	-25	25	70 ± 10	0.483 ± 0.069
	315	1500	10.5	400	"	"	-25	"	"	"	"	"	"	"
	320	2000	14.0	400	"	"	"	"	"	"	"	"	"	"
RS 410	40 ± 5	1000	7.0	400	"	"	-35	"	"	"	"	"	100 ± 15	0.689 ± 0.103
	*415	1500	10.5	400	"	+7	"	"	"	"	"	"	"	"
	*420	2000	14.0	400	"	"	"	"	"	"	"	"	"	"
PS *510	50 ± 5	1000	7.0	400	"	+10	"	-35	"	"	"	"	140 ± 20	0.965 ± 0.138
	*515	1500	10.5	400	"	+7	"	-25	"	"	"	"	"	"
	*520	2000	14.0	400	"	"	"	"	"	"	"	"	"	"
	*525	2500	17.5	400	"	"	"	"	"	"	"	"	"	"
RS *610	60 ± 5	1000	7.0	300	"	+10	"	-35	"	"	"	"	195 ± 30	1.344 ± 0.207
	*615	1500	10.5	350	"	+7	"	-25	"	"	"	"	"	"
	*620	2000	14.0	400	"	"	"	"	"	"	"	"	"	"
	*625	2500	17.5	400	"	"	"	"	"	"	"	"	"	"
RS *710	70 ± 5	1000	7.0	200	"	+10	"	-35	"	"	"	"	300 ± 70	2.068 ± 0.483
	*715	1500	10.5	250	"	+7	"	-25	"	"	"	"	"	"
	*720	2000	14.0	300	"	"	"	"	"	"	"	"	"	"
	*725	2500	17.5	300	"	"	"	"	"	"	"	"	"	"
RS 810	80 ± 5	1000	7.0	150	"	+10	"	-35	"	"	"	"	675 ± 100	3.275 ± 0.690
	815	1500	10.5	150	"	+7	"	-25	"	"	"	"	"	"
	820	2000	14.0	200	"	"	"	"	"	"	"	"	"	"
RS 910	90 ± 5	1000	7.0	100	"	+10	"	-35	"	"	"	"	"	"
	915	1500	10.5	150	"	+7	"	-25	"	"	"	"	"	"

Table V - Physical Requirements of Rubber Compositions - Type S, Class SA

Grade number	Durometer hardness number		Tensile strength min.		Ultimate elongation, min.	Volume change %	Compression set after 22 hr. at 158 F (70 C) max. %	Requirements added by suffix letter						
	40 ± 5	50 ± 5	psi	MPa				Suffix A ₁ Heat aged 70 at 212 F (100 C) Hardness change, max. Tensile change Elongation change, max.		Suffix B ₁ Compression set after 70 hr. at 212 F (100 C) max. %		Suffix E ₃ Oil aged 70 hr. at 212 F (100 C) ASTM Oil #3 Hardness change (limits) Tensile change Elongation change		
SA 405	40 ± 5	50 ± 5	500	3.5	400	0 to +10	60	+10	-15	-30		-5 to +10	-20	-40
SA 505	50 ± 5	50 ± 5	500	3.5	400	"	"	"	"	"		"	"	"
SA 605	60 ± 5	50 ± 5	500	3.5	300	"	"	"	"	"		"	"	"
610			1000	7.0	300	"	"	"	"	"		"	"	"
620			2000	14.0	300	"	"	"	"	"		"	"	"
SA 705	70 ± 5	50 ± 5	500	3.5	250	"	"	"	"	"		"	"	"
710			1000	7.0	250	"	"	"	"	"		"	"	"
720			2000	14.0	300	"	"	"	"	"		"	"	"
SA 805	80 ± 5	50 ± 5	500	3.5	150	"	"	"	"	"		"	"	"
810			1000	7.0	150	"	"	"	"	"		"	"	"
SA 905	90 ± 5	50 ± 5	500	3.5	100	"	"	"	"	"		"	"	"
910			1000	7.0	100	"	"	"	"	"		"	"	"

MIL-STD-417A(Rev)

Table VI - Physical Requirements of Rubber Compositions - Type S, Class SB

Grade number	Durometer hardness number	Tensile strength		Ultimate elongation %	Oil aged 70 hr. at 212 F (100 F) ASTM Oil #3	Requirements added by suffix letter											
		psi	MPa			Suffix A ₁			Suffix B ₁			Suffix E ₃			Suffix E ₅		
						Heat aged 70 hr. at 212 F (100 C)	Change, Max. %	Penetration Change, Max. %	Compression set after 70 hr at 212 F (100 C)	Change, Max. %	Change, Max. %	Change, Max. %	Change, Max. %	Change in durometer hardness	Volume change	Change, Max. %	Change, Max. %
SB 410	40 ± 5	1000	7.0	450	0 to +60	+15	-20	-40	35	-45	-10 to +5	0 to 25	+50				
SB 415		1500	10.5	450													
SB 505	50 ± 5	300	3.5	300													
SB 510		1000	7.0	350													
*515		1500	10.5	400													
SB 620		2000	14.0	400													
SB 605	60 ± 5	300	3.5	200													
*610		1000	7.0	250													
*615		1500	10.5	300													
SB 680		2000	14.0	350													
SB 705	70 ± 5	300	3.5	150													
710		1000	7.0	200													
*715		1500	10.5	250													
720		2000	14.0	250													
725		2500	17.5	300													
SB 805	80 ± 5	300	3.5	100													
810		1000	7.0	100													
815		1500	10.5	125													
820		2000	14.0	125													
SB 905	90 ± 5	300	3.5	50													
910		1000	7.0	100													
915		1500	10.5	100													

*Grades most commonly used.

Table VII - Physical Requirements of Synthetic Rubber Compositions - Type S, Class SC

Grade number	Duroometer hardness number	Tensile strength min. psi	Tensile strength min. MPa	Ultimate elongation %	Oil aged 70 hr. at 212 F (100 C) ASTM Oil #3	Requirements added by suffix letter																																								
						Suffix A ₁	Suffix B ₁	Suffix E ₃	Suffix R	Suffix E ₅																																				
SC 305	30 ± 5	500	3.5	300	Volume change %	Compression set after 22 hr. at 158 F (70 C)	Heat aged 70 hr. at 212 F (100 C)	Change, H.R.	Tensile	Elongation	Change, H.R.	Compression set after 70 hr. at 212 F (100 C)	Change, H.R.	Tensile	Elongation	Change, H.R.	Yerzley Resilience at 30% def.	Blow formation	7 days at room temp. ASTM Fuel B	Volume change % max.																										
																					+15	-15	-35	-65	-50	70	60																			
																					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"							
																					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"						
																					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"					
SC 405	40 ± 5	500	3.5	300	Volume change %	Compression set after 22 hr. at 158 F (70 C)	Heat aged 70 hr. at 212 F (100 C)	Change, H.R.	Tensile	Elongation	Change, H.R.	Compression set after 70 hr. at 212 F (100 C)	Change, H.R.	Tensile	Elongation	Change, H.R.	Yerzley Resilience at 30% def.	Blow formation	7 days at room temp. ASTM Fuel B	Volume change % max.																										
																					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"							
																					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"				
																					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"			
																					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"		
SC 505	50 ± 5	500	3.5	300	Volume change %	Compression set after 22 hr. at 158 F (70 C)	Heat aged 70 hr. at 212 F (100 C)	Change, H.R.	Tensile	Elongation	Change, H.R.	Compression set after 70 hr. at 212 F (100 C)	Change, H.R.	Tensile	Elongation	Change, H.R.	Yerzley Resilience at 30% def.	Blow formation	7 days at room temp. ASTM Fuel B	Volume change % max.																										
																					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"						
																					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"		
																					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	
																					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	
SC 605	60 ± 5	500	3.5	300	Volume change %	Compression set after 22 hr. at 158 F (70 C)	Heat aged 70 hr. at 212 F (100 C)	Change, H.R.	Tensile	Elongation	Change, H.R.	Compression set after 70 hr. at 212 F (100 C)	Change, H.R.	Tensile	Elongation	Change, H.R.	Yerzley Resilience at 30% def.	Blow formation	7 days at room temp. ASTM Fuel B	Volume change % max.																										
																					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"				
																					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	
																					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
																					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
SC 705	70 ± 5	500	3.5	200	Volume change %	Compression set after 22 hr. at 158 F (70 C)	Heat aged 70 hr. at 212 F (100 C)	Change, H.R.	Tensile	Elongation	Change, H.R.	Compression set after 70 hr. at 212 F (100 C)	Change, H.R.	Tensile	Elongation	Change, H.R.	Yerzley Resilience at 30% def.	Blow formation	7 days at room temp. ASTM Fuel B	Volume change % max.																										
																					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"				
																					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	
																					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
																					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
SC 805	80 ± 5	500	3.5	200	Volume change %	Compression set after 22 hr. at 158 F (70 C)	Heat aged 70 hr. at 212 F (100 C)	Change, H.R.	Tensile	Elongation	Change, H.R.	Compression set after 70 hr. at 212 F (100 C)	Change, H.R.	Tensile	Elongation	Change, H.R.	Yerzley Resilience at 30% def.	Blow formation	7 days at room temp. ASTM Fuel B	Volume change % max.																										
																					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"			
																					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
																					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
																					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"

*Grades most commonly used.

MIL-STD-417A(MR)

Table VII - Physical Requirements of Synthetic Rubber Compositions - Type S, Class SC (cont'd)

	Basic requirements						Requirements added by suffix letter								
	80 ± 5	500	3.5	100	"	"	"	"	"	"	"	"	"	"	"
SC 805		500	3.5	100	"	"	"	"	"	"	"	"	"	"	"
810		1000	7.0	100	"	"	"	"	"	"	"	"	"	"	"
815		1500	10.5	100	"	"	"	"	"	"	"	"	"	"	"
820		2000	14.0	100	"	"	"	"	"	"	"	"	"	"	"
SC 905	90 ± 5	500	3.5	100	"	"	"	"	"	"	"	"	"	"	"
910		1000	7.0	100	"	"	"	"	"	"	"	"	"	"	"
915		1500	10.5	100	"	"	"	"	"	"	"	"	"	"	"

TABLE VIII
Physical Requirements of Synthetic Rubber Compositions Type 7, Class 7A

Grade Number	Durometer Hardness Number	Tensile strength psi min.	Elongation at break % min.	Modulus at 300 P (150 C) at 57 F (235 C)	Requirements Added to Suffix Letters				Suffix H Water absorption after 70 hr. in boiling v. or volume change max. %						
					Suffix B ₁					Suffix O Tear strength min. lb./in. M/m					
					Suffix B ₁ 70 hr. at 302 F (150 C) ASTM D111		Suffix B ₂ 70 hr. at 302 F (150 C) ASTM D111								
					Change, %	Tensile strength, psi	Change, %	Tensile strength, psi							
TA605	40 ± 5	500	3-5	300	±10	-25	-40	Pass	-30	+60	Pass	50	8.76	Pass	±5
TA605	50 ± 5	500	3-5	350	±10	-25	-40	Pass	-30	+60	Pass	50	8.76	Pass	±5
TA607	50 ± 5	700	5.0	450	±10	-25	-40	Pass	-30	+60	Pass	50	8.76	Pass	±5
TA505	50 ± 5	500	3-5	300	±10	-25	-30	Pass	-30	+60	Pass	50	7.88	Pass	±5
TA506	50 ± 5	700	4.5	175	±10	-30	-30	Pass	-30	+60	Pass	50	8.76	Pass	±5
TA507	50 ± 5	1000	7.0	400	±10	-40	-40	Pass	-30	+60	Pass	100	17.51	Pass	±5
TA510	50 ± 5	1000	7.0	500	±15	-50	-50	Pass	-30	+60	Pass	150	26.27	Pass	±5
TA512	50 ± 5	1200	8.5	450	±15	-50	-50	Pass	-30	+60	Pass	150	26.27	Pass	±5
TA605	60 ± 5	500	3-5	300	±10	-25	-30	Pass	-30	+60	Pass	40	7.00	Pass	±5
TA606	60 ± 5	700	4.5	150	±10	-30	-30	Pass	-30	+60	Pass	50	8.76	Pass	±5
TA607	60 ± 5	800	5.0	200	±10	-30	-30	Pass	-30	+60	Pass	50	8.76	Pass	±5
TA608	60 ± 5	1000	7.0	225	±15	-40	-40	Pass	-30	+60	Pass	80	14.00	Pass	±5
TA610	60 ± 5	1000	7.0	200	±10	-40	-40	Pass	-30	+60	Pass	100	17.51	Pass	±5
TA610	60 ± 5	1000	7.0	300	±10	-40	-40	Pass	-30	+60	Pass	100	17.51	Pass	±5
TA612	60 ± 5	1200	8.5	200	±15	-50	-50	Pass	-30	+60	Pass	150	26.27	Pass	±5
TA705	70 ± 5	500	3-5	75	±10	-85	-30	Pass	-40	+10	Pass	50	8.75	Pass	±5
TA706	70 ± 5	600	4.5	125	±10	-30	-30	Pass	-40	+10	Pass	50	8.76	Pass	±5
TA706	70 ± 5	600	4.5	150	±10	-30	-30	Pass	-40	+10	Pass	50	8.76	Pass	±5
TA707	70 ± 5	800	5.0	200	±10	-40	-40	Pass	-40	+10	Pass	100	17.51	Pass	±5
TA710	70 ± 5	1000	7.0	200	±10	-40	-40	Pass	-40	+10	Pass	100	17.51	Pass	±5
TA805	80 ± 5	500	3-5	50	±10	-85	-30	Pass	-45	+10	Pass	50	8.76	Pass	±5
TA806	80 ± 5	600	4.5	100	±10	-85	-30	Pass	-45	+10	Pass	50	8.76	Pass	±5
TA807	80 ± 5	700	5.0	150	±10	-30	-40	Pass	-45	+10	Pass	80	14.00	Pass	±5
TA810	80 ± 5	1000	7.0	200	±15	-40	-40	Pass	-45	+10	Pass	80	14.00	Pass	±5

MIL-STD-417A(MR)

11-510-417A(2)

Table IX - Physical Requirements of Synthetic Rubber Compositions - Type T, Class TB

Grade number	Durometer hardness number	Tensile strength min. psi	Tensile strength min. MPa	Ultimate elongation %	Compression set after 70 hr at 302 °F (150 C), max. %	Requirements added by suffix letter													
						Suffix A				Suffix E				Suffix F					
Heat aged 70 hr. at 347 °F (175 C)						70 hr. at 302 °F (150 C) ASTM Oil #3				70 hr. at 302 °F (150 C) ASTM Service Fluid #100									
Hardness change		Tensile change max. %		Elongation change max. %		Hardness change max.		Tensile change max. %		Elongation change max. %		Hardness change		Tensile change max. %		Elongation change max. %		Volume change %	
TB 405	40 ± 5	500	3.5	200	60	0 to +10	-30	-50	-10	-30	-20	0 to +20	-5 to +10	-10	-10	-10	-3 to +5		
TB 510	50 ± 5	1000	7.0	200	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
TB 610	60 ± 5	1000	7.0	200	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
615		1500	10.5	200	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
TB 710	70 ± 5	1000	7.0	150	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
715		1500	10.5	150	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
TB 810	80 ± 5	1000	7.0	100	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
815		1500	10.5	100	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"

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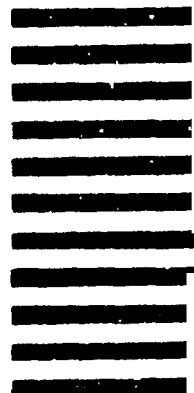
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(See Instructions Reverse Side)

1 DOCUMENT NUMBER		2 DOCUMENT TITLE	
3a. NAME OF SUBMITTING ORGANIZATION		4. TYPE OF ORGANIZATION <i>(Mark one)</i>	
b. ADDRESS <i>(Street, City, State, ZIP Code)</i>		<input type="checkbox"/> VENDOR	
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5. PROBLEM AREAS			
a. Paragraph Number and Wording			
b. Recommended Wording			
c. Reason/Rationale for Recommendation			
6. REMARKS			
7. NAME OF SUBMITTER <i>(Last, First, MI - Optional)</i>		b. WORK TELEPHONE NUMBER <i>(Include Area Code - Optional)</i>	
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