U. S. Department of Commerce
Maurice H. Stans
Secretary

National Bureau of Standards
A. M. Branscomb, Director

Certificate

STANDARD REFERENCE MATERIAL 386g
Styrene Butadiene Rubber
Type 1500

Standard Reference Material 386g has the following characteristics when tested by procedures described in the appendix. The uncertainty limits for the values reflect both variation within the lot of rubber and error of test, and are based on a confidence coefficient of 95 percent.

PROCEDURE I

Characteristics	Value (Conventional Units)	Value (SI* Units)
Mooney Viscosity at 100 °C		
Rubber	51.4 ± 0.6 ML1 + 4	
Compound	63.0 ± 0.3 ML1 + 4	
Viscometer Cure at 145 °C		
Incipient Cure, t_5	11.95 ± 0.15 minutes	717 ± 9 seconds
Cure Index, Δt	6.25 ± 0.15 minutes	375 ± 9 seconds
Stress at 300% Elongation		
Cure: 25 min at 145 °C	410 ± 30 lb/in²	2.8 ± 0.2 MN/m²
50 min at 145 °C	985 ± 30 lb/in²	6.8 ± 0.2 MN/m²
100 min at 145 °C	1450 ± 30 lb/in²	10.0 ± 0.2 MN/m²
Stress at Failure		
Cure: 25 min at 145 °C	2770 ± 100 lb/in²	19.1 ± 0.7 MN/m²
50 min at 145 °C	4130 ± 100 lb/in²	28.5 ± 0.7 MN/m²
100 min at 145 °C	3780 ± 100 lb/in²	26.1 ± 0.7 MN/m²
Elongation at Failure		
Cure: 25 min at 145 °C	925 ± 20%	
50 min at 145 °C	680 ± 15%	
100 min at 145 °C	530 ± 10%	
Strain at 2MN/m² (290 lb/in²)		
Cure: 25 min at 145 °C	264 ± 4%	
50 min at 145 °C	142 ± 2%	
100 min at 145 °C	102 ± 2%	
Electrical Resistivity		
Cure: 100 min at 145 °C	28 ± 2 megohm-cm	280000 ± 20000 ohm-m

*International System of Units (Système International)

Values certified by methods prescribed for Procedure II are tabulated on the reverse page.

This lot of rubber was evaluated in the National Bureau of Standards, Institute for Applied Technology, by George W. Bullman, and Albert M. Brown of the Viscoelastic Materials Section, George E. Decker, Acting Chief.

Washington, D. C. 20234
October 10, 1969

J. Paul Cali, Acting Chief
Office of Standard Reference Materials

PROCEDURE II

Characteristics	Value (Conventional Units)	Value (SI Units)
Mooney Viscosity at 100 °C		
Compound	82.2 ± 0.5 ML1 + 4	
Viscometer Cure at 150 °C		
Incipient Cure, t_5	10.50 ± 0.25 minute	630 ± 15 seconds
Cure Index, Δt	3.45 ± 0.15 minute	207 ± 9 seconds
Stress at 300% Elongation		
Cure: 15 min at 145 °C	930 ± 45 lb/in²	6.4 ± 0.3 MN/m²
30 min at 145 °C	1945 ± 45 lb/in²	13.4 ± 0.3 MN/m²
60 min at 145 °C	2545 ± 45 lb/in²	17.5 ± 0.3 MN/m²
Stress at Failure		
Cure: 15 min at 145 °C	2450 ± 150 lb/in²	16.9 ± 1.0 MN/m²
30 min at 145 °C	3910 ± 150 lb/in²	27.0 ± 1.0 MN/m²
60 min at 145 °C	4070 ± 150 lb/in²	28.1 ± 1.0 MN/m²
Elongation at Failure		
Cure: 15 min at 145 °C	645 ± 15%	
30 min at 145 °C	525 ± 15%	
60 min at 145 °C	435 ± 15 %	
Strain at 2MN/m² (290 lb/in²)		
Cure: 15 min at 145 °C	165 ± 6%	
30 min at 145 °C	96 ± 2%	
60 min at 145 °C	76 ± 1%	
Electrical Resistivity		
Cure: 60 min at 145 °C	0.010 ± 0.002 megohm-cm	100 ± 20 ohm-meter

APPENDIX TO CERTIFICATE FOR STANDARD REFERENCE MATERIAL 386g

MATERIAL: Standard Reference Material 386g was selected from the central portion of a carefully prepared lot of SBR 1500. The latex was blended and dried and compressed into bales weighing approximately 34 kg, wrapped in polyethylene and packaged in multiwall paper bags.

TESTS: A portion was taken from every 25th bale as the lot was produced. Two determinations of Mooney viscosity were made on each portion according to the procedure described in ASTM Designation D 1646-68 using integral dies in the viscometer and mechanical closure.

PROCEDURE I—Four compounds were mixed from each 150th bale according to the formulation and mixing procedure described in ASTM Designation D 15-68a for Standard Formula 2B; the black was conditioned for 24 hours at 23° ± 1° and 35 ± 5 percent relative humidity before weighing. The same conditions prevailed during mixing of the compound. After mixing and before testing, the compound was stored in a desiccator containing calcium chloride. The Mooney viscosity of the compound and the viscometer cure characteristics were determined at 145 °C according to ASTM Designation D 1646-68. The cure index was selected as the time required to increase from 5 to 35 points above the minimum.

The remaining compound was remilled, and vulcanized at 145 °C, as described in ASTM Designation D 15-68a using a four-cavity mold machined directly in the hot plates of the press. After remilling and before curing, the compound was stored in a desiccator containing calcium chloride. The period of vulcanization was 25, 50, and 100 minutes.

PROCEDURE II—Four compounds were mixed from each 75th bale in the following manner: The formulation proposed by Technical Committee 45 on Rubber of the International Organization for Standardization was used; namely, rubber 300g, NBS 378 oil furnace black 150g, NBS 370 zinc oxide 9g, NBS 371 sulfur 5.25g, NBS 372 stearic acid 3g, NBS 384 N-tertiary-butyl-2-benzothiazylsulfenamide 3g. The following procedure was used for mixing the ingredients on a standard mill at 50 ± 5 °C:

STEP		MINUTES
1.	Band rubber on slow mill roll with clearance between rolls 1.1 mm (0.045 in). Make ¾ cuts every 30 seconds from alternate sides.	7
2.	Add sulfur slowly and evenly along the rolls.	2
3.	Add stearic acid. Make one ¾ cut from each side after stearic acid is incorporated.	2
4.	Add carbon black evenly along the rolls at a uniform rate. Increase the clearance to 1.3 mm (0.050 in) when half the black is added. Make one ¾ cut from each side. Add remainder of black, including black that drops into the mill pan. When black is incorporated, increase the clearance to 1.4 mm (0.055 in).	10
5.	Add other materials.	3
6.	Make three ¾ cuts from each side.	2
7.	Remove the rubber batch from the mill. Adjust roll clearance to 0.8 mm (0.032 in) and pass rolled batch endwise through mill six times.	2
8.	Sheet the batch to a minimum thickness of 6 mm (0.24 in) and weight it.	1

STEP	MINUTES
9. Prepare specimens for Mooney viscosity tests and sheet the remainder of the batch to a thickness of about 2.2 mm (0.085 in). Cut pieces for vulcanization and store in a desiccator containing calcium chloride.	
10. Vulcanize sheets at 145 °C for 15, 30, and 60 minutes between 2 and 6 hours after batch is sheeted in accordance with ASTM D 15–68a.	

The following NBS Standard Reference Materials were used to prepare compounds by Procedures I and II: Zinc oxide-370b, Sulfur-371e, Stearic Acid-372e, Benzothiazyl disulfide-373e, Channel black-375e, and N-tertiary-butyl-2-benzothiazylsulfenamide-384.

Stress 300 percent elongation, stress at failure, and elongation at failure were measured as described in ASTM Designation D 412–68 using Die C. Strain at $2MN/m^2$ (290 lb/in^2) was measured as described in ASTM Designation D 1456–61. Electrical resistivity was measured as described in Ind. Eng. Chem. **44**, 159 (1952).