

## Certificate

### Standard Reference Material 389 Styrene Butadiene Rubber Type 1503

Standard Sample 389 has the following characteristics when tested by procedure described in the appendix overleaf. 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.

Characteristics	Units	Procedure
Mooney viscosity at 100 °C		
Rubber	ML1 +4	54.4 ±1.0
Compound	ML1 +4	69.5 ±0.5
Viscometer cure		
Incipient cure, $t_5$	min	8.15 ±0.1
Cure index, $\Delta t$	min	2.06 ±0.05
Rheometer cure		
Incipient cure, $t_2$	min	8.95 ±0.15
Cure A	in -lb	37.5 ±1.1
Cure B	in -lb	75.91 ±0.8
Cure C	in -lb	82.81 ±0.5
Stress at 300 % elongation		
Cure A	lb/in <sup>2</sup>	1090 ±20
Cure B	lb/in <sup>2</sup>	1930 ±20
Cure C	lb/in <sup>2</sup>	2215 ±20
Stress at failure		
Cure A	lb/in <sup>2</sup>	4110 ±150
Cure B	lb/in <sup>2</sup>	4190 ±150
Cure C	lb/in <sup>2</sup>	3965 ±150
Elongation at failure		
Cure A	%	650 ±15
Cure B	%	475 ±15
Cure C	%	415 ±15
Strain at 400 lb/in <sup>2</sup>		
Cure A	%	194 ±5
Cure B	%	138 ±1
Cure C	%	127 ±1
Electrical Resistivity		
Cure C	megohm-cm	0.6 ±0.2

This lot of rubber was evaluated in the National Bureau of Standards Institute for Materials Research, by George E. Decker, George W. Bullman, and Albert M. Brown of the Evaluation Criteria Section, Robert D. Stiehler, Chief.

WASHINGTON, D. C. 20234  
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W. WAYNE MEINKE, Chief  
 Office of Standard Reference Materials

(Over)

**MATERIAL:** Standard Sample 389 was selected from the central portion of a carefully prepared lot of SBR 1503. The latex was blended and coagulated on one finishing line. The coagulated rubber was thoroughly dried and compressed into bales weighing approximately 34 kg, and packaged in multiwall polyethylene lined 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 1646-63 using integral dies in the viscometer and mechanical closure. Four compounds were mixed from each 50th bale according to the formulation given in table 1. The mixing procedure described in ASTM Designation D 15-64T for Standard Formulation 2B was used with one exception; after all of the pigment had been added in Step 4, the compound was transferred from the slow roll to the fast roll for all subsequent operations since the compound sagged from the slow roll. The mill room was maintained at  $23 \pm 1$  °C and  $35 \pm 2$  percent relative humidity. The black was dried for 1 hr at  $100 \pm 2$  °C and the temperature of 150 °C was used for vulcanization and for determining cure characteristics. 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 according to ASTM Designation D 1646-63. The cure index was selected as the time required to increase from 5 to 35 points above the minimum. Rheometer cure was determined as described in Rubber Chem. and Technol. **36**, 451 (1963). The time for the torque to increase two units above the minimum, and the torque at the times noted below for cures A, B, and C were measured.

The remaining compound was remilled, and vulcanized, as described in ASTM Designation D 15-64T using a four-cavity mold machined directly in the hot plates of the press. The period of vulcanization was 15, 30, and 60 min for cures A, B, and C, respectively. After remilling and before curing, the compound was again stored in a desiccator containing calcium chloride.

The following NBS Standard Samples were used to prepare compounds: ZnO-370b, S-371e, stearic acid-372e, N-tertiary-butyl-2-benzothiazole-sulfenamide-384, and oil furnace black-378a.

Stress at 300 percent elongation, stress at failure, and elongation at failure were measured as described in ASTM Designation D 412-62T using Die C. Strain at 400 lb/in<sup>2</sup> was measured as described in ASTM Designation D 1456-61. Electric resistivity was measured as described in Ind. Eng. Chem. **44**, 159 (1952).

TABLE 1

<u>Ingredient</u>	<u>NBS Standard Sample No.</u>	<u>Weight per hundred grams</u>
SBR 1503	389	100
Zinc oxide	370b	3
Stearic acid	372f	1
Sulfur	371e	1.75
N-tertiary-butyl-2- benzothiazole-sulfenamide	384	1
Oil furnace black	378a	40