

National Bureau of Standards

Certificate

Standard Reference Material 388j

Isobutylene - Isoprene (Butyl) Rubber

Standard Reference Material 388j has the following characteristics when tested by the procedures described in the appendix. The standard error of the certified value and the standard deviation for a single measurement are defined in the appendix.

RAW ELASTOMER

Mooney Viscosity

	<u>Certified Value</u>	<u>Standard Error</u>	<u>Standard Deviation</u>
Mooney Viscosity at 100°C (ML1+8)	68.7	0.04	0.26
Mooney Viscosity at 125°C (ML1+8)	46.5	0.05	0.29

NON-BLACK FILLED COMPOUND

	<u>Certified Value</u>	<u>Standard Error</u>	<u>Standard Deviation</u>
<u>Viscometer Cure at 150°C</u>			
Minimum Viscosity (ML)	36.0	0.06	0.19
Incipient Cure, t_5 (s)	395	1.1	4.6
Cure Index, Δt (s)	118	0.7	2.6
<u>60 Second Strain at 0.5 MPa Stress ∇ (%)</u>			
900 second cure	189	1.1	2.5
1800 second cure	143	0.7	1.8
2400 second cure	133	0.3	1.5

∇ compound cured at 150°C

BLACK FILLED COMPOUND

	<u>Certified Value</u>	<u>Standard Error</u>	<u>Standard Deviation</u>
<u>Viscometer Cure at 150°C</u>			
Minimum Viscosity (ML)	58.9	0.29	0.83
Incipient Cure, t_{5t} (s)	370	26.0	33.7
Cure Index, Δt (s)	98	2.2	5.4

Oscillating Disk Curemeter at 160°C

	<u>Certified Value</u>	<u>Standard Error</u>	<u>Standard Deviation</u>
Minimum Torque (N·m)	1.18	0.009	0.029
Maximum Torque (N·m)	4.29	0.016	0.052
Incipient Cure ^a t_{s1} (s)	212	1.5	3.7
Cure Time, t_c (50) (s)	466	2.0	5.0
Cure Time, t_c (90) (s)	1745	12.2	29.3

^aRise of 1 lb-in (.130 N·m)

(over)

Appendix to Certificate for Standard Reference Material 388j

The Standard error of the certified value expresses the uncertainty of the estimate of the mean value of the property of the lot of rubber and includes the effects of measurement error, bale-to-bale variability, and day-to-day variability.

The standard deviation for a single measurement expresses the uncertainty of the value expected from a single bale tested on a single day from the lot, e.g., the uncertainty expected for a typical result from an ASTM test conducted by the SRM user.

MATERIAL: Standard Reference Material 388j was selected from a lot of 11R Type 218. Bales of the dried rubber weighing approximately 34 kg were wrapped with polyethylene film, and packaged in cardboard cartons. To evaluate the lot, 1000-gram portions were taken at the start and during the filling of each fifth container.

Non-Black Filled Compound - Thirty-two compounds were prepared from eight portions in accordance with the mixing procedure described in ASTM Designation D-3182-73. The formulation was Standard Formula IE described in ASTM Designation D15-72. All sample preparation took place in a room conditioned at $23 \pm 1^\circ\text{C}$ and $35 \pm 5\%$ relative humidity.

Black Filled Compound - Sixteen compounds were prepared from four portions in accordance with the formulation and mixing procedure described in ASTM Designation D-3188-73 for Standard Formula 1A. The oil furnace black was dried for one hour at 125°C before weighing and the mixing was done in a room conditioned at $23 \pm 1^\circ\text{C}$ and $35 \pm 5\%$ relative humidity.

TESTS: Two determinations of Mooney Viscosity were made on each portion according to the procedure described in ASTM Designation D-1646-74.

The viscometer cure characteristics of each compound were determined at 150°C according to ASTM Designation D-1646-74 selecting the time required to increase the cure index from 5 to 35 points above the minimum. The vulcanization characteristics were determined with an oscillating disk curemeter at 160°C according to ASTM Designation D-2084-75. The compound mechanical properties were determined from sheets vulcanized at 150°C as described in ASTM Designation D-3182-73. The vulcanization was performed in a four cavity mold that was machined directly in the hot plates of the press. Stress at 300% elongation, stress at failure, and elongation at failure were measured in accordance with ASTM Designation D-412-68 using Die C. Strain at 60 seconds was measured as described in ASTM Designation D-1456-61.

The following NBS Standard Reference Materials were used to prepare the compounds: Zinc Oxide-370e, Sulfur-371g, Stearic Acid-372h, Tetramethylthiuram Disulfide-374c, and Oil Furnace Black-378b.