

Certificate of Analysis

Standard Reference Material 388e Butyl Rubber

Standard Reference Material 388e has the following characteristics when tested by procedures 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. The Mooney viscosity of the rubber is 72.8 ± 1.0 ML 1+8 (100 °C).

Characteristic of Compound	Units	Procedure A	Procedure B	Procedure C
Viscometer cure at 150°C.				
Minimum viscosity	ML	38.3 ± 0.5	59.1 ± 0.8	59.8 ± 1.0
Incipient cure, t_5	min	6.20 ± 0.15	5.99 ± 0.06	5.44 ± 0.06
Cure index, Δt	min	2.02 ± 0.03	1.40 ± 0.02	1.33 ± 0.02
Stress at given elongation*				
Cure A	lb/in ²	—	970 ± 30	875 ± 35
Cure B	lb/in ²	—	1320 ± 30	1245 ± 35
Cure C	lb/in ²	—	1615 ± 30	1620 ± 35
Stress at failure				
Cure A	lb/in ²	—	2900 ± 60	2570 ± 60
Cure B	lb/in ²	—	2850 ± 60	2520 ± 60
Cure C	lb/in ²	—	2820 ± 60	2520 ± 60
Elongation at failure				
Cure A	%	—	775 ± 25	660 ± 20
Cure B	%	—	660 ± 15	535 ± 15
Cure C	%	—	590 ± 10	450 ± 10
Strain at 400 lb/in ²				
Cure A	%	—	244 ± 8	194 ± 5
Cure B	%	—	196 ± 3	146 ± 4
Cure C	%	—	173 ± 2	121 ± 3
Strain at 5 kg/cm ²				
Cure A	%	189 ± 3	—	—
Cure B	%	136 ± 3	—	—
Cure C	%	114 ± 3	—	—
Electrical resistivity				
Cure C	megohm-cm	—	0.10 ± 0.01	—

*Stress at 400% elongation for compounds prepared under procedure B.
 Stress at 300% elongation for compounds prepared under procedure C.

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

Washington, D. C. 20234
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W. Wayne Meinke, Chief
 Office of Standard Reference Materials

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APPENDIX TO CERTIFICATE FOR STANDARD REFERENCE MATERIAL 388e

MATERIAL—Standard Reference Material 388e was selected from a lot of IIR 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, a 1000-gram portion was taken at the start and during the filling of each fifth container.

TESTS—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. The fabric-reinforced rubber grommet previously used in the lower die was replaced by an O-ring described in NBS Report 9948. This change lowers the values for the Mooney viscosity of butyl rubber by about 1.5 units.

Procedure A — Forty-eight compounds were prepared from twelve portions in accordance with the formulation and mixing procedure described in ASTM D 15-66 T for Standard Formula 1E in a room conditioned at 23 ± 1 °C and 35 ± 3 % relative humidity.

Procedure B — Twenty-four compounds were prepared from six portions in accordance with the formulation and mixing procedure described in ASTM Designation D 15-66 T for Standard Formula 2E; and black was dried for one hour at 100 °C before weighing and the mixing done in a room conditioned at 23 ± 1 °C and 35 ± 3 % relative humidity.

Procedure C — Twenty-four compounds were prepared from six portions using the following formulation in grams: rubber 200, zinc oxide 6, sulfur 3.5, stearic acid 2, tetramethylthiuram-disulfide 2, and oil furnace black 100. The conditioning of black and mixing were the same as procedure B.

The following NBS Standard Reference Materials were used to prepare the compounds: Zinc Oxide-370c, Sulfur-371e, Stearic Acid-372g, Benzothiazyl-disulfide-373e, Tetramethylthiuram-disulfide-374b, Channel Black-375e and Oil Furnace Black-378a.

The viscometer cure characteristics of each compound were determined at 150 °C according to ASTM Designation D 1646-68 selecting for the cure index the time required to increase from 5 to 35 points above the minimum. The remaining compound was vulcanized at 150 °C as described in ASTM Designation D 15-66 T using a four-cavity mold machined directly in the hot plates of the press for the following periods:

Procedure A — 10, 20, and 40 minutes for cures A, B, and C, respectively;

Procedure B — 25, 50, and 100 minutes for cures A, B, and C, respectively;

Procedure C — 20, 40, and 60 minutes for cures A, B, and C, respectively.

Stress at given elongation, stress at failure, and elongation at failure were measured on vulcanizates prepared by Procedures B and C in accordance with ASTM Designation D 412-66 using Die C. Strain was measured as described in ASTM Designation D 1456-61 using a load of 5 kg/cm² for those prepared by Procedure A and 400 lb/in² for vulcanizates prepared by Procedures B and C.