

UNITED STATES DEPARTMENT OF COMMERCE  
NATIONAL BUREAU OF STANDARDS  
WASHINGTON 25, D. C.

## National Bureau of Standards

### Certificate

FOR  
STANDARD SAMPLE 388c  
BUTYL RUBBER

Standard Sample 388c 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%. The Mooney viscosity of the rubber is  $72.8 \pm 1.2$  ML 1+8 (100° C).

CHARACTERISTIC OF COMPOUND	UNITS	PROCEDURE I	PROCEDURE II
<u>Viscometer cure at 150° C</u>			
Minimum viscosity	ML	59.4 ± 0.8	38.0 ± 0.6
Incipient Cure, $t_5$	min	6.17 ± 0.05	6.35 ± 0.10
Cure Index, $\Delta t$	min	1.46 ± 0.03	2.18 ± 0.08
<u>Rheometer Cure at 150° C</u>			
Incipient Cure, $t_1$	min	6.64 ± 0.1	7.1 ± 0.3
Cure A	in-lb	46.1 ± 1.0	16.1 ± 0.7
Cure B	in-lb	55.6 ± 1.0	40.7 ± 0.7
Cure C	in-lb	61.4 ± 1.0	52.0 ± 0.7
<u>Stress at 400% Elongation</u>			
Cure A	lb/in <sup>2</sup>	975 ± 45	-
Cure B	lb/in <sup>2</sup>	1350 ± 45	-
Cure C	lb/in <sup>2</sup>	1650 ± 45	-
<u>Stress at Failure</u>			
Cure A	lb/in <sup>2</sup>	3030 ± 50	-
Cure B	lb/in <sup>2</sup>	3040 ± 50	-
Cure C	lb/in <sup>2</sup>	3030 ± 50	-
<u>Elongation at Failure</u>			
Cure A	%	755 ± 15	-
Cure B	%	670 ± 15	-
Cure C	%	610 ± 15	-
<u>Strain at 400 lb/in<sup>2</sup></u>			
Cure A	%	263 ± 5	-
Cure B	%	207 ± 5	-
Cure C	%	182 ± 5	-
<u>Strain at 5 kg/cm<sup>2</sup></u>			
Cure A	%	-	277 ± 3
Cure B	%	-	163 ± 3
Cure C	%	-	137 ± 3
<u>Electrical Resistivity</u>			
Cure C	megohm-cm	0.068 ± 0.007	-

For the Director,  
by *Robert D. Stiehler*  
Robert D. Stiehler, Chief  
Evaluation Criteria Section  
Materials Evaluation Laboratory

March 1, 1965

APPENDIX TO CERTIFICATE FOR STANDARD SAMPLE 388c

MATERIAL: Standard Sample 388c was selected from a lot of IIR Type 218, prepared from a single slurry tank of crumb. Sheets of the dried rubber weighing approximately 25 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 1646-63 using integral dies in the viscometer.

Procedure I - Thirty-two compounds were prepared from eight portions in accordance with the formulation and mixing procedure described in ASTM Designation D 15-62T for Standard Formula 2D; the 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 II - Thirty-two compounds were prepared from eight portions in accordance with the formulation and mixing procedure described in ASTM D 15-62T for Standard Formula 1D in a room conditioned at 23° ± 1° C and 35 ± 3% relative humidity.

The following NBS Standard Samples were used to prepare compounds by Procedures I and II: ZnO 370b, S 371d, Stearic Acid 372e, Benzothiazyl Disulfide 373e, Tetramthyl Thiuram Disulfide 374b, and Channel Black 375e.

The viscometer cure characteristics of each compound were determined at 150° C according to ASTM Designation D 1646-63 selecting for the cure index 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 one in-lb above the minimum and the torque at the times noted below for cures A, B, and C were measured. The remaining compound was vulcanized at 150° C as described in ASTM Designation D 15-62T using a four-cavity mold machined directly in the hot plates of the press for the following periods:  
Procedure I - 25, 50 and 100 minutes for cures A, B, and C, respectively;  
Procedure II - 10, 20, and 40 minutes for cures A, B, and C, respectively.

Stress at 400% elongation, stress at failure, and elongation at failure were measured on vulcanizates prepared by Procedure I in accordance with ASTM Designation D 412-61T using Die C. Strain was measured as described in ASTM Designation D 1456-61 using a load of 400 lb/in<sup>2</sup> for vulcanizates prepared by Procedure I and 5 kg/cm<sup>2</sup> for those prepared by Procedure II.