



Standard Test Method for Rubber—Evaluation of Chloroprene Rubber (CR)¹

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1. Scope

1.1 This test method covers the standard materials, test formulas, mixing procedures and test methods for evaluation and quality control testing of chloroprene rubbers (CR). CR can be generally classified according to the two types of polymerization modifiers used in their manufacture: sulfur modified types and mercaptan modified types.

1.2 The values stated in SI-units are to be regarded as the standard. The values in parentheses are for information only.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*²

[D412 Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension](#)

[D1646 Test Methods for Rubber—Viscosity, Stress Relaxation, and Pre-Vulcanization Characteristics \(Mooney Viscometer\)](#)

[D2084 Test Method for Rubber Property—Vulcanization Using Oscillating Disk Cure Meter](#)

[D3182 Practice for Rubber—Materials, Equipment, and Procedures for Mixing Standard Compounds and Preparing Standard Vulcanized Sheets](#)

[D3896 Practice for Rubber From Synthetic Sources—Sampling](#)

[D4483 Practice for Evaluating Precision for Test Method Standards in the Rubber and Carbon Black Manufacturing Industries](#)

[D5289 Test Method for Rubber Property—Vulcanization Using Rotorless Cure Meters](#)

[D6204 Test Method for Rubber—Measurement of Unvulcanized Rheological Properties Using Rotorless Shear Rheometers](#)

3. Summary of Test Method

3.1 Separate standard gum or carbon black filled formulations, or both, using different samples of CR, are prepared on a laboratory mill or in a Miniature Internal Mixer (MIM) in accordance with Practice [D3182](#).

3.2 See Test Method [D1646](#) for Mooney scorch times and Test Method [D2084](#) or [D5289](#) for cure meter data of the formulations.

3.3 Tensile sheets for stress/strain testing are vulcanized in accordance with Practice [D3182](#) and 100 and 300 % modulus, tensile strength and elongation at break are measured in accordance with Test Method [D412](#).

4. Significance and Use

4.1 This test method is intended for referee purposes, but may be used for quality control, research and development testing and comparison of different rubber samples in a standard formula.

4.2 This test method may also be used to obtain values for customer acceptance of rubber.

4.3 This test method is a revision of Test Methods D3190 (prior to 1991), with 3-methyl thiazolidine thione-2 being substituted for ethylene thiourea (ETU), a suspected carcinogen.

5. Standard Test Formulae

5.1 The Standard Test Formulae are shown in [Table 1](#). Formulae Nos. 1 and 2 shall be used for sulfur modified CR and Nos. 3 and 4 for mercaptan modified CR.

6. Sample Preparation

6.1 Obtain and prepare the test samples in accordance with Practice [D3896](#).

7. Mixing Procedure

7.1 The following three mixing procedures are offered:

7.1.1 *Mill Method A*—For Formulae Nos. 1 and 2.

7.1.2 *Mill Method B*—For Formulae Nos. 3 and 4.

¹ This test method is under the jurisdiction of ASTM Committee D11 on Rubber and is the direct responsibility of Subcommittee D11.23 on Synthetic Rubbers.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

TABLE 1 Standard Test Formulae

Formula	1	2	3	4
Chloroprene rubber				
Sulfur modified	100.00	100.00	...	...
Mercaptan modified	...	...	100.00	100.00
Stearic acid, SRM 372 ^{A,B}	0.50	0.50	...	...
Magnesium oxide ^{A,B,C}	4.00	4.00	4.00	4.00
IRB No. 6	...	25.00	...	25.00
Zinc oxide, IRM 91 ^{A,B}	5.00	5.00	5.00	5.00
3-methyl thiazolidine thione-2-80 % in polymeric binder ^D (curative)	...	...	0.45	0.45
Total	109.50	134.50	109.45	134.45
Batch factors ^E				
Laboratory mill	3.00	3.00	3.00	3.00
MIM (Cam Head)	0.76	0.63	0.76	0.63
MIM (Banbury Head)	0.65	0.54	0.65	0.54

^A For the MIM procedure it is recommended that a blend of the identified ingredients be prepared to improve accuracy in the weighing. The blend is made by mixing a proportional mass of each material in a dry powder blender (see Practice D3182). A mortar and pestle may be used for small quantities.

^B Use current IRM/SRM.

^C Maglite D, available from Marine Magnesium Company, 995 Beaver Grade Rd., Coraopolis, PA 15061.

^D Rhenogran MTT 80, available from Rhein Chemie Corporation, 1008 Whitehead Rd. Ext., Trenton, NJ 08638 or Rhein Chemie Rheinland GmbH, Mülheimer Str. 24–28, D6800 Mannheim 81, Germany.

^E For mill mixes, weigh the rubber and carbon black to the nearest 1.0 g, ingredients identified with footnote ^A to the nearest 0.1 g, and the curative^C to the nearest 0.001 g. For MIM mixes weigh the rubber, carbon black and ingredient blend to the nearest 0.1 g, individual ingredients, if used, to the nearest 0.01 g and the curative^C to the nearest 0.001 g. Note that the curative tolerances given are lower than those specified in the referenced Practice D3182.

TABLE 2 Method A—Mill Mix Cycle for Formulae 1 and 2

	Duration, min	
	Gum	Black
Maintain roll temperatures at 50 ± 5°C (122 ± 9°F).		
Set the mill opening at about 1.5 mm (0.060 in.), band 300 g of rubber prepared in 7.2 and maintain a rolling bank.	1	1
Add stearic acid.	1	1
Add magnesium oxide slowly, spreading it evenly over the entire width of the band. Ensure complete addition before adding the next material.	2	2
Add carbon black. Open the mill at intervals to maintain a rolling bank.	...	5
Add zinc oxide.	2	2
Make three three-quarter cuts from alternate sides and cut stock from the mill.	2	2
Set the rolls at 0.8 mm (0.032 in.). Pass the rolled stock endwise through the mill six times.	2	2
Open the mill to give a minium stock thickness of 6 mm (0.25 in.) and pass the stock through the rolls four times, folding it back on itself.	0	0
Total time	10	15

7.1.3 *Miniature Internal Mixer Method*—For Formulae Nos. 1, 2, 3 and 4.

7.1.4 *Laboratory Banbury*—All Formulae

NOTE 1—It is not implied that comparable results will be obtained by these methods.

NOTE 2—The indicated mill openings are desired and should be maintained in so far as possible to provide a standard for breakdown of the rubber due to milling.

7.2 *Raw Rubber Preparation:*

7.2.1 With the mill roll temperature maintained at 50 ± 5°C (122 ± 9°F), set the mill opening at 1.5 mm (0.060 in.) and band 320 g of CR on the slow roll for 6 min. Adjust the mill opening to maintain a rolling bank approximately 12.5 mm (0.5 in.) in diameter.

7.2.2 Remove the rubber from the mill, allow to cool to room temperature and weigh an amount equal to 300 g prior to mixing.

7.3 *Mill Method A*—Procedure for Formulae Nos. 1 and 2 (sulfur modified CR). See Table 2.

7.3.1 For general mixing, weighing and vulcanization procedures, refer to Practice D3182.

7.3.1.1 After mixing according to Table 2, measure and record the batch mass. If it differs from the theoretical value by more than 0.5 % for the carbon black stock and by 0.3 % for the gum stock, discard the batch.

7.3.1.2 If required, cut a sample to allow testing for scorch time in accordance with Test Methods D1646. The scorch test should be performed between 1 to 2 h after mixing using a test temperature of 125 ± 1°C (257 ± 1.8°F) for a rise of 5 Mooney units above the minimum with the large rotor. If also

required, cut samples from the batch to allow testing of compound viscosity and processability in accordance with Test Methods D1646 or D6204, and vulcanization characteristics in accordance with Test Methods D2084 or D5289.

7.3.1.3 If tensile stress strain tests are required, sheet off to a finished thickness of approximately 2.2 mm (0.087 in.) and condition the compound according to Practice D3182.

7.4 *Mill Method B*—Procedure for Formulae Nos. 3 and 4 (mercaptan modified CR). See Table 3.

7.4.1 For general mixing, weighing and vulcanization procedures, refer to Practice D3182.

7.4.1.1 After mixing according to Table 3, measure and record the batch mass. If it differs from the theoretical value by more than 0.5 % for the carbon black stock and by 0.3 % for the gum stock, discard the batch.

7.4.1.2 If required, cut a sample to allow testing for scorch time in accordance with Test Methods D1646. The scorch test should be performed between 1 to 2 h after mixing using a test temperature of 125 ± 1°C (257 ± 1.8°F) for a rise of 5 Mooney units above the minimum with the large rotor. If also required, cut samples from the batch to allow testing of compound viscosity and processability in accordance with Test Methods D1646 or D6204, and vulcanization characteristics in accordance with Test Methods D2084 or D5289.

7.4.1.3 If tensile stress strain tests are required, sheet off to a finished thickness of approximately 2.2 mm (0.087 in.) and condition the compound according to Practice D3182.

7.5 *Miniature Internal Mixer (MIM)*—Procedure for Formulae Nos. 1, 2, 3 and 4 (sulfur and mercaptan modified CR). See Table 4.

TABLE 3 Method B—Mill Mix Cycle for Formulae 3 and 4

	Duration, min	
	Gum	Black
Maintain roll temperatures at $50 \pm 5^\circ\text{C}$ ($122 \pm 9^\circ\text{F}$). Set the mill opening at about 1.5 mm (0.060 in.), band 300 g of rubber prepared in 7.2 and maintain a rolling bank.	1	1
Add magnesium oxide slowly, spreading it evenly over entire width of the band. Ensure complete addition before adding the next material.	2	2
Add carbon black. Open the mill at intervals to maintain a rolling bank.	...	5
Add zinc oxide.	2	2
Add curative (see Table 1 , footnote ^D).	1	1
Make three three-quarter cuts from alternate sides and cut stock from the mill.	2	2
Set the rolls at 0.8 mm (0.032 in.). Pass the rolled stock endwise through the mill six times.	2	2
Open the mill to give a minimum stock thickness of 6 mm (0.25 in.) and pass the stock through the rolls four times, folding it back on itself.	0	0
Total time	10	15

TABLE 4 Miniature Internal Mixer Mix Cycle

	Duration, min	
	Gum	Black
Charge the mixing chamber with the rubber prepared in 7.5.2 , lower the ram and start the timer.	0	0
Masticate the rubber.	1	1
Raise the ram, add the pre-blended powders and curative (see Table 1 , footnote ^D), taking care to avoid losses. Sweep the orifice and lower the ram.	2	1
Raise the ram, add carbon black, lower the ram and allow batch to mix.	...	7
Total time	3	9

7.5.1 For general mixing, weighing and vulcanization procedures, refer to Practice [D3182](#).

7.5.1.1 Mix with the head temperature of the MIM maintained at $60 \pm 3^\circ\text{C}$ ($140 \pm 5^\circ\text{F}$) and a rotor speed at 6.3 to 6.6 rad/s (60 to 63 r/min).

7.5.2 *Raw rubber preparation*—Perform procedures in this section prior to mixing according to [Table 4](#). Batch fractors: Cam head 0.80; Banbury head 0.68:

7.5.2.1 Cut the rubber into small pieces, weigh the appropriate amount and charge it into the mixing chamber. Lower the ram, start the timer and masticate the rubber for 6 min.

7.5.2.2 Turn off the rotors, raise the ram, remove the mixing chamber and discharge the rubber.

7.5.2.3 Cut the rubber into small pieces, allow to cool to room temperature and weigh prior to mixing.

7.5.3 After mixing according to [Table 4](#), turn off the rotors, raise the ram, remove the mixing chamber, and discharge the batch. Record the maximum batch temperature, if desired.

7.5.4 Immediately pass the discharge from the mixer twice through a standard mill maintained at $50 \pm 5^\circ\text{C}$ ($122 \pm 9^\circ\text{F}$) with a roll separation of 0.5 mm (0.020 in.) once, then twice at a separation of 3 mm (0.12 in.) in order to dissipate heat. Pass the rolled batch endwise through the mill six times with an opening of 0.8 mm (0.31 in.) to enhance the dispersion.

7.5.5 Measure and record the batch mass. If it differs from the theoretical value by more than 0.5 % for the carbon black stock and by 0.3 % for the gum stock, discard the batch.

7.5.6 If required, cut a sample to allow testing for scorch time in accordance with Test Methods [D1646](#). The scorch test should be performed between 1 to 2 h after mixing using a test temperature of $125 \pm 1^\circ\text{C}$ ($257 \pm 1.8^\circ\text{F}$) for a rise of 5 Mooney units above the minimum with the large rotor. If also required, cut samples from the batch to allow testing of compound viscosity and processability in accordance with Test Methods [D1646](#) or [D6204](#), and vulcanization characteristics in accordance with Test Methods [D2084](#) or [D5289](#).

7.5.7 If tensile stress strain tests are required, sheet off to a finished thickness of approximately 2.2 mm (0.087 in.) and condition the compound according to Practice [D3182](#).

7.6 Internal Mixer Procedure:

7.6.1 For general mixing procedure refer to Practice [D3182](#).

7.6.2 *Mixing Cycle-Initial Mix*—See [Table 5](#).

7.6.2.1 After mixing according to [Table 5](#), measure and record the batch mass. If it differs from the theoretical value by more than 0.5 %, discard the batch.

7.6.2.2 Pass the batch immediately through the standard laboratory mill three times, set at 6.0 mm (0.25 in.) and $40 \pm 5^\circ\text{C}$ ($104 \pm 9^\circ\text{F}$).

7.6.2.3 Allow the batch to rest for 1 to 24 h.

7.6.3 *Final Mix*—See [Table 6](#).

7.6.3.1 Adjust the internal mixer temperature to $40 \pm 5^\circ\text{C}$ ($104 \pm 9^\circ\text{F}$), turn off steam and turn on full cooling water to the rotors, start the rotors at 8.1 rad/s (77 rpm), and raise the ram.

7.6.3.2 After mixing according to [Table 6](#), measure and record the batch mass. If it differs from the theoretical value by more than 0.5 % for the carbon black stock and by 0.3 % for the gum stock, discard the batch.

7.6.3.3 If required, cut a sample to allow testing for scorch time in accordance with Test Methods [D1646](#). The scorch test should be performed between 1 to 2 h after mixing using a test temperature of $125 \pm 1^\circ\text{C}$ ($257 \pm 1.8^\circ\text{F}$) for a rise of 5 Mooney units above the minimum with the large rotor. If also required, cut samples from the batch to allow testing of compound viscosity and processability in accordance with Test Methods [D1646](#) or [D6204](#), and vulcanization characteristics in accordance with Test Methods [D2084](#) or [D5289](#).

7.6.3.4 If tensile stress strain tests are required, sheet off to a finished thickness of approximately 2.2 mm (0.087 in.) and condition the compound according to Practice [D3182](#).

TABLE 5 Internal Mixer Cycle—Initial Mix

	Duration, min	Accumulative, min
Adjust the internal mixer temperature to achieve the discharge conditions outlined below. Close the discharge gate, start the rotor at 8.1 rad/s (77 rpm) and raise the ram.	0	0
Charge one half the rubber, all of the zinc oxide, carbon black, stearic acid, and then the other one half of the rubber. Lower the ram.	0.5 3.0	0.5 3.5
Allow the batch to mix.	0.5	4.0
Raise the ram and clean the mixer throat and the top of the ram. Lower the ram.		
Allow the batch to mix until a temperature of 170°C (338°F) or a total mixing time of 6 min is reached, whichever occurs first. Discharge the batch.	2.0	6.0

TABLE 6 Internal Mixer Cycle—Final Mix

	Duration, min	Accumulative, min
Charge ½ the batch, with all the sulfur and accelerator rolled into this portion of the batch before feeding to the mixer. Add the remaining portion of the batch. Lower the ram.	0.5	0.5
Allow the batch to mix until a temperature of 110 ± 5°C (230 ± 9°F) or a total mixing time of 3 min is reached, whichever occurs first. Discharge the batch.	2.5	3.0
With the rolls of a standard laboratory mill maintained at 40 ± 5°C (104 ± 9°F) and set at 0.8 mm (0.032 in.) opening, pass the rolled batch endwise through the rolls six times.	2.0	5.0
Open the rolls to give a minimum thickness of 6 mm (0.25 in.) and pass the compound through four times, folding it back on itself each time.	1.0	6.0

8. Preparation and Testing of Vulcanizates

8.1 For stress/strain testing, prepare the test sheets and vulcanize them in accordance with Practice **D3182**.

8.1.1 The recommended standard vulcanization time and temperature is 15 min at 160°C (320°F).

8.1.2 Condition the vulcanized sheets for 16 to 96 h at a temperature of 23 ± 3°C (73.4 ± 5.4°F) prior to testing.

NOTE 3—Quality control of rubber production may require testing within 1 to 6 h to provide close surveillance, however, slightly different results may be obtained.

8.1.3 Prepare test specimens and obtain modulus, tensile strength and elongation at break in accordance with Test Method **D412**.

8.2 An alternative to measuring vulcanization characteristics by means of tensile stress measurement on vulcanizates is the measurement of vulcanization characteristics in accordance with Test Method **D2084** (Oscillating Disk Cure Meter) or Test Method **D5289** (Rotorless Cure Meter). These methods will not produce equal results.

8.2.1 The recommended Test Method **D2084** test conditions are 1.67 Hz (100 cpm) oscillation frequency, 1° oscillation amplitude, 160°C die temperature, 30-min test time, and no

preheating. The recommended Test Method **D5289** test conditions are 1.67 Hz (100 cpm) oscillation frequency, 0.5° oscillation amplitude, 160°C die temperature, 30-min test time, and no preheating. Test condition tolerances are specified by the test methods.

8.2.2 The recommended standard test parameters are M_L , M_H , t_{sb} , $t'50$, and $t'90$.

NOTE 4—It is recommended that M_H , if applicable, be taken as the torque value at 30 min.

9. Report

9.1 Report the following information:

9.1.1 Proper sample identification.

9.1.2 Mixing procedure used (mill or MIM).

9.1.3 Vulcanization characteristics including Mooney scorch time (ML t_5 at 125°C (257°F)) and cure meter results (MH, MHF or MHR, ML, t_{s1} and $t'90$ at 160°C (320°F)).

9.1.4 Stress/strain data for 15 min cure at 160°C (320°F) (100 % and 300 % modulus, tensile strength and elongation at break).

9.1.5 Identification of any deviation from the specified standard procedures used in mixing, specimen preparation and testing.

TABLE 7 Type 2 Precision, Vulcanization Parameters and Stress/Strain Properties of CR

NOTE 1— S_r = within laboratory standard deviation; r = repeatability (in measured units); (r) = repeatability (as percent of material average); S_R = between laboratory standard deviation; R = reproducibility (in measurement units); (R) = reproducibility (as percent of material average).

Property	Mean	Within Laboratory			Between Laboratory		
		S_r	r	(r)	S_R	R	(R)
CR-Sulfur Grade							
<i>Formula No. 1 (gum):</i>							
ML t5 (min)	29.7	2.31	6.47	21.8	3.83	10.73	36.2
ML (dNm)	3.5	0.19	0.54	15.6	0.77	2.15	61.8
MH (dNm)	32.9	0.55	1.55	4.7	1.72	4.83	14.7
ts1 (min)	3.9	0.16	0.44	11.4	0.43	1.20	31.3
t90 (min)	9.2	0.24	0.66	7.2	1.88	5.27	57.4
100 % M (MPa)	1.2	0.04	0.10	8.5	0.07	0.19	15.6
300 % M (MPa)	2.2	0.07	0.21	9.6	0.11	0.32	14.8
Tensile (MPa)	26.1	1.13	3.16	12.1	1.75	4.89	18.7
Elongation (%)	875	13.89	38.90	4.4	27.30	76.44	8.7
<i>Formula No. 2 (black):</i>							
ML t5 (min)	19.4	3.72	10.43	53.8	3.72	10.43	53.8
ML (dNm)	5.7	0.28	0.80	14.0	1.16	3.24	56.7
MH (dNm)	53.9	1.03	2.87	5.3	2.97	8.32	15.4
ts1 (min)	2.1	0.22	0.61	28.6	0.51	1.43	66.7
t90 (min)	8.6	0.52	1.45	16.8	1.36	3.81	44.1
100 % M (MPa)	3.0	0.10	0.27	9.0	0.17	0.48	16.1
300 % M (MPa)	11.8	0.41	1.15	9.8	0.60	1.67	14.2
Tensile (MPa)	26.1	0.77	2.15	8.3	1.66	4.65	17.8
Elongation (%)	597	16.65	46.62	7.8	32.00	89.60	15.0
CR-Mercaptan Grade							
<i>Formula No. 3 (gum):</i>							
ML t5 (min)	26.7	3.16	8.84	33.1	5.37	15.03	56.3
ML (dNm)	4.5	0.18	0.50	11.2	0.90	2.51	55.7
MH (dNm)	26.6	0.55	1.55	5.8	1.00	2.80	10.5
ts1 (min)	4.3	0.37	1.02	23.8	0.58	1.63	37.8
t90 (min)	10.7	1.37	3.85	36.1	2.15	6.01	56.4
100 % M (MPa)	0.9	0.02	0.07	7.3	0.05	0.14	15.3
300 % M (MPa)	1.7	0.07	0.20	12.2	0.12	0.33	20.2
Tensile (MPa)	17.2	1.35	3.78	21.9	1.98	5.55	32.2
Elongation (%)	780	25.89	72.51	9.3	28.84	80.76	10.4
<i>Formula No. 4 (black):</i>							
ML t5 (min)	11.4	0.80	2.24	19.6	2.29	6.41	56.2
ML (dNm)	7.6	0.27	0.77	10.1	1.02	2.87	37.9
MH (dNm)	47.5	0.69	1.93	4.1	3.31	9.27	19.5
ts1 (min)	2.2	0.10	0.28	12.9	0.32	0.89	41.1
t90 (min)	10.7	0.87	2.43	24.6	2.47	6.91	69.8
100 % M (MPa)	2.6	0.12	0.34	13.2	0.24	0.67	25.6
300 % M (MPa)	14.5	0.69	1.94	13.4	1.18	3.31	22.8
Tensile (MPa)	24.3	1.24	3.48	14.2	1.51	4.23	17.4
Elongation (%)	441	23.58	66.03	15.0	34.17	95.67	21.7

10. Precision and Bias³

10.1 This precision and bias section has been prepared in accordance with Practice D4483 for terminology and other statistical calculation details.

10.2 The precision results in this precision and bias section give an estimate of the precision of these test methods with the materials (rubbers) used in the particular interlaboratory program as described below. The precision parameters should not be used for acceptance/rejection testing of any group of materials without documentation that they are applicable to

those particular materials and the specific testing protocols that include this test method.

10.3 A Type 2 interlaboratory precision program was conducted using the mill mix procedure. Both repeatability and reproducibility are short term; a period of a few days separates replicate test results. A test result is a value, as specified by this test method, obtained for one determination (measurement) of the selected property.

10.4 Two different types of CR were evaluated for precision; sulfur and mercaptan modified CR. Each CR was tested in eight laboratories on two different days. On each of the two days, duplicate tests were obtained. The analysis for precision followed the general procedure as set forth in Annex 5 of

³ Supporting data have been filed at ASTM International Headquarters and may be obtained by requesting Research Report RR: D11-1073.

Practice **D4483**. Each cell of the Practice **D4483** **Table 1** basic data format, contained four values (two test days, two test results each day). The estimates for the repeatability parameters therefore contain two undifferentiated sources of variation; replicates within days and between days. The final precision parameters are given in **Table 7** of this test method.

10.5 The precision of these test methods may be expressed in the format of the following statements that use an “appropriate value” of r , R , (r) or (R) , to be used in decisions about the test results. The appropriate value is that value of r or R associated with a mean level in **Table 7** closest to the mean level under consideration at any given time, for any given test and for any given material in routine testing operations.

10.6 *Repeatability*—The repeatability, r , of these test methods has been established as the appropriate value tabulated in **Table 7**. Two single test results, obtained under normal test method procedures in the same laboratory, that differ by more than this tabulated r (for any given level) must be considered as derived from different populations.

10.7 *Reproducibility*—The reproducibility, R , of these test methods has been established as the appropriate value tabulated in **Table 7**. Two single test results obtained in two different laboratories, under normal test method procedures, that differ by more than the tabulated R (for any given level) must be considered to have come from different populations.

10.8 Repeatability and reproducibility expressed in percentage of the mean level, (r) and (R) , have equivalent application statements as above for r and R . For the (r) and (R) statements, the difference in two single test results is expressed as a percentage of the arithmetic mean of the two test results.

10.9 *Bias*—In test terminology, bias is the difference between an average test value and the reference (or true) test property value. Reference values do not exist for these test methods, since the value (of the test property) is exclusively defined by the test methods. Therefore, bias cannot be determined.

11. Keywords

11.1 CR; evaluation of chloroprene

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