
International Standard



2303

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Rubber, polyisoprene (IR) — Non oil-extended, solution-polymerized types — Test recipe and evaluation of vulcanization characteristics

Caoutchouc polyisoprène (IR) — Types polymérisés en solution et non étendus à l'huile — Formule d'essai et évaluation des caractéristiques de vulcanisation

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been authorized has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 2303 was developed by Technical Committee ISO/TC 45, *Rubber and rubber products*.

This second edition was submitted directly to the ISO Council, in accordance with clause 6.11.2 of part 1 of the Directives for the technical work of ISO. It cancels and replaces the first edition (i.e. ISO 2303-1975), which had been approved by the member bodies of the following countries:

Australia	France	Spain
Belgium	Germany, F.R.	Sweden
Brazil	Hungary	Thailand
Bulgaria	Italy	Turkey
Canada	Netherlands	United Kingdom
Chile	New Zealand	USA
Czechoslovakia	Poland	USSR
Egypt, Arab Rep. of	Romania	Yugoslavia

No member body had expressed disapproval of the document.

Rubber, polyisoprene (IR) — Non oil-extended, solution-polymerized types — Test recipe and evaluation of vulcanization characteristics

1 Scope and field of application

This International Standard specifies standard materials, equipment and processing methods for evaluating vulcanization characteristics of non oil-extended, solution-polymerized polyisoprene rubbers (IR).

2 References

ISO 37, *Rubber, vulcanized — Determination of tensile stress-strain properties.*

ISO 1795, *Raw rubber in bales — Sampling.*

ISO 1796, *Rubber, raw — Sample preparation.*

ISO 2393, *Rubber test mixes — Preparation, mixing and vulcanization — Equipment and procedures.*

ISO 3417, *Rubber — Measurement of vulcanization characteristics with the oscillating disc curemeter.*

3 Test recipe

3.1 Standard test formula

The standard test formula is given in the table.

The materials shall be NBS¹⁾ standard reference materials as indicated in the table, or shall be in accordance with equivalent national standards.

Table

Material	NBS standard reference material number	Parts by mass
Polyisoprene rubber (IR)	—	100,00
Stearic acid	372	2,00
Zinc oxide	370	5,00
Sulphur	371	2,25
Oil furnace black (HAF)*	378	35,00
TBBS**	384	0,70
		144,95

* The current Industry Reference Black may be used in place of NBS 378, but this may give slightly different results.

** *N-tert-butyl-2-benzothiazole-sulphenamide*. This shall be supplied in powder form having an initial ether- or ethanol-insoluble matter content of less than 0,3 %. The material shall be stored at room temperature in a closed container and the ether- or ethanol-insoluble matter shall be checked every 6 months. If this is found to exceed 0,75 %, the material shall be discarded or recrystallized.

3.2 Procedure

3.2.1 Equipment and procedure

Equipment and procedure for the preparation, mixing and vulcanization shall be in accordance with ISO 2393.

3.2.2 Mill mixing procedure

The standard laboratory mill batch mass, in grams, shall be based on four times the formula mass. The surface temperature of the rolls shall be maintained at 70 ± 5 °C throughout the mixing.

NOTE — All mill openings should be adjusted to maintain a good rolling bank at the nip of the rolls during mixing.

1) National Bureau of Standards of the USA.

	Duration (min)	
3.2.2.1 Pass the rubber between the rolls twice without banding, with the mill opening set at 0,5 mm	2	
3.2.2.2 Band the rubber with the mill opening set at 1,4 mm and make two 3/4 cuts from each side	2	
NOTE — Some types of polyisoprene rubber go to the back roll, in which case the stearic acid should be added and after its incorporation the rubber can usually be transferred to the front roll. In addition, certain tougher types of polyisoprene rubber may require slightly longer breakdown before the addition of other materials in order to obtain a good rolling bank.		
3.2.2.3 Set the mill opening to 1,7 mm and add the stearic acid. Make one 3/4 cut from each side	2	
3.2.2.4 Add the zinc oxide and the sulphur. Make one 3/4 cut from each side	3	
3.2.2.5 Add the carbon black evenly across the mill at a uniform rate. When about half the black has been incorporated, open the mill to 1,9 mm and make one 3/4 cut from each side. Then add the remainder of the carbon black. Be certain to add the black that has dropped into the mill pan. When all the black has been incorporated, make one 3/4 cut from each side	13	
3.2.2.6 Add the TBBS with the mill opening still at 1,9 mm. Make three 3/4 cuts from each side	2	
3.2.2.7 Cut the batch from the mill. Set the mill opening to 0,8 mm and pass the rolled batch endwise through the rolls six times	3	
Total time	27	

3.2.2.10 Condition the batch for 2 to 24 h after mixing and prior to vulcanizing.

4 Evaluation of vulcanization characteristics

4.1 Evaluation according to stress-strain properties

Vulcanize sheets at 135 °C for three periods selected from a cure series of 20, 30, 40 and 60 min.

NOTE — The three periods of cure selected should cover the undercure, optimum cure and overcure of the polymer under test.

Condition the vulcanized test slab for 16 to 72 h.

Measure the stress-strain properties in accordance with ISO 37.

4.2 Evaluation according to oscillating disc curemeter test

Measure the following standard test parameters:

$M_L, M_H, t_{st}, t'_c(50)$ and $t'_c(90)$	in accordance with ISO 3417, using the following test conditions
oscillation frequency:	1,7 Hz (100 cycles per minute)
amplitude of oscillation:	1° arc
selectivity:	to be chosen to give at least 75 % full scale deflection at M_H
die temperature:	160 °C
pre-heat time:	none

5 Precision

To be added later.

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