
**Chloroprene rubber (CR) — General-
purpose types — Evaluation procedure**

*Caoutchouc chloroprène (CR) — Types à usage général — Méthode
d'évaluation*

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Contents

Page

Foreword	iv
1 Scope	1
2 Normative references	1
3 Sampling and sample preparation	2
4 Physical and chemical tests on raw rubber	2
4.1 Mooney viscosity	2
4.2 Volatile matter	2
4.3 Ash	2
5 Sulfur-modified chloroprene rubbers — Preparation of the test mix for evaluation	2
5.1 Standard test formulation	2
5.2 Procedure	3
6 Mercaptan-modified chloroprene rubbers — Preparation of the test mix for evaluation	4
6.1 Standard test formulation	4
6.2 Procedure	5
7 Preparation of the test mix for evaluation of sulfur-modified or mercaptan-modified chloroprene with miniature internal mixer (MIM)	7
7.1 Standard test formulations	7
7.2 Procedure	7
8 Evaluation of vulcanization characteristics by a curemeter test	8
8.1 Using an oscillating-disc curemeter	8
8.2 Using a rotorless curemeter	8
9 Evaluation of tensile stress-strain properties of vulcanized test mixes	8
10 Precision	9
11 Test report	9
Annex A (informative) Precision statement	10
Bibliography	12

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established 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. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 2475 was prepared by Technical Committee ISO/TC 45, *Rubber and rubber products*, Subcommittee SC 3, *Raw materials (including latex) for use in the rubber industry*.

This fifth edition cancels and replaces the fourth edition (ISO 2475:1999), in which:

- the normative references have been updated;
- the precision data (Clause 10) have been moved to informative Annex A.

It also incorporates the Amendment ISO 2475:1999/Amd.1:2005 and the Technical Corrigendum ISO 2475:1999/Cor.1:2001.

Chloroprene rubber (CR) — General-purpose types — Evaluation procedure

WARNING — Persons using this International Standard should be familiar with normal laboratory practice. This standard does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user to establish appropriate safety and health practices and to ensure compliance with any national regulatory conditions.

1 Scope

This International Standard specifies, for general-purpose chloroprene rubbers (CRs):

- physical and chemical tests on raw rubbers;
- standard materials, standard test formulations, equipment and processing methods for evaluating the vulcanization characteristics.

General-purpose chloroprene rubbers fall into three broad classes based on the type of polymerization modifier used in their preparation:

- a) sulfur-modified types; [ISO 2475:2011](https://standards.iteh.ai/catalog/standards/sist/1d867dc2-3242-4535-a8e5-a3cc08e66653/iso-2475-2011)
- b) mercaptan-modified types; <https://standards.iteh.ai/catalog/standards/sist/1d867dc2-3242-4535-a8e5-a3cc08e66653/iso-2475-2011>
- c) types modified by other products.

For class c), the procedure for either a) or b) may be followed.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

ISO 247, *Rubber — Determination of ash*

ISO 248-1:2011, *Rubber, raw — Determination of volatile-matter content — Part 1: Hot-mill method and oven method*

ISO 289-1, *Rubber, unvulcanized — Determinations using a shearing-disc viscometer — Part 1: Determination of Mooney viscosity*

ISO 1795, *Rubber, raw natural and raw synthetic — Sampling and further preparative procedures*

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

ISO 2475:2011(E)

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

ISO 6502, *Rubber — Guide to the use of curemeters*

ISO 23529, *Rubber — General procedures for preparing and conditioning test pieces for physical test methods*

3 Sampling and sample preparation

3.1 Take a sample of mass approximately 1,5 kg by the method described in ISO 1795.

3.2 Prepare the test portion in accordance with ISO 1795.

4 Physical and chemical tests on raw rubber

4.1 Mooney viscosity

Determine the Mooney viscosity in accordance with ISO 289-1, on a test portion prepared as indicated in 3.2. Record the result as ML(1 + 4) at 100 °C.

4.2 Volatile matter

Determine the volatile-matter content in accordance with ISO 248-1:2011, either by the oven method or, if the rubber is in a suitable form (which is not the case if it is in chip or powder form), the hot-mill method, but with a mill roll temperature of 50 °C ± 5 °C.

4.3 Ash

Determine the ash in accordance with ISO 247.

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5 Sulfur-modified chloroprene rubbers — Preparation of the test mix for evaluation

5.1 Standard test formulation

The standard test formulation is given in Table 1.

The materials shall be national or international standard reference materials, unless no standard reference materials are available, in which case the materials to be used shall be agreed between the interested parties.

Table 1 — Standard test formulation for evaluation of sulfur-modified chloroprene rubbers

Material	Parts by mass
Chloroprene rubber (CR), sulfur-modified	100,00
Stearic acid ^a	0,50
Magnesium oxide ^b	4,00
Carbon black ^c	25,00
Zinc oxide ^d	5,00
Total	134,50
<p>^a See ISO 8312.</p> <p>^b The surface area of the magnesium oxide shall be between 130 m²/g and 200 m²/g. Magnesium oxide absorbs water and carbon dioxide when exposed to air and this can affect its activity in compounds. Store it in a dry environment.</p> <p>^c The current industry reference black (IRB), or an equivalent national or international standard reference material, shall be used.</p> <p>^d Class B1a (see ISO 9298:1995, Annex D).</p>	

5.2 Procedure

5.2.1 Equipment and procedure

The equipment and procedure for preparation, mixing, and vulcanization shall be in accordance with ISO 2393.

5.2.2 Premastication

ISO 2475:2011

5.2.2.1 Weigh out 500 g of chloroprene rubber

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5.2.2.2 Adjust the mill-roll temperature to 50 °C ± 5 °C.

5.2.2.3 Band the rubber with a mill opening of 1,5 mm and start the timer at the instant the rubber is banded.

5.2.2.4 Adjust the nip to maintain a rolling bank of approximately 12 mm in diameter. Mill the rubber for 6 min, cutting as necessary to maintain a rolling bank and a tight band.

5.2.2.5 Remove the rubber from the mill and allow it to cool to room temperature prior to mixing.

5.2.3 Mill mixing procedure

The standard laboratory mill batch mass shall be based on four times the recipe mass in grams.

The surface temperature of the rolls shall be maintained at 50 °C ± 5 °C throughout the mixing.

A good rolling bank at the nip of the rolls shall be maintained during mixing. If this is not obtained with the nip settings specified hereunder, small adjustments to the mill opening might be necessary.

	Duration (min)
a) Band the premasticated rubber on the mill with a nip setting of 1,5 mm or a suitable setting to maintain a rolling bank	1,0
b) Add the stearic acid	1,0
c) Add the magnesium oxide slowly, spreading it evenly over the entire width of the band. Ensure complete incorporation before adding the carbon black	2,0
d) Add the carbon black. Open the nip at intervals to maintain a rolling bank. Sweep up and add any material which has fallen into the pan	5,0
e) Add the zinc oxide	2,0
f) Make three 3/4 cuts from each side	2,0
g) Cut the batch from the mill. Set the nip at 0,8 mm and pass the rolled batch lengthways through the mill six times	2,0
Total time	15,0
h) Sheet the batch to an approximate thickness of 6 mm and check-weigh the batch (see ISO 2393). If the mass of the batch differs from the theoretical value by more than +0,5 %/–1,5 %, discard the batch and re-mix. Remove sufficient material for curemeter testing.	
i) Sheet the batch to an approximate thickness of 2,2 mm for preparing test slabs or to the appropriate thickness for preparing ISO ring specimens in accordance with ISO 37.	
j) Condition the batch for 2 h to 24 h after mixing and prior to vulcanizing, if possible at standard temperature and humidity as defined in ISO 23529.	

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6 Mercaptan-modified chloroprene rubbers — Preparation of the test mix for evaluation

6.1 Standard test formulation

The standard test formulation is given in Table 2.

The materials shall be national or international standard reference materials, unless no standard reference materials are available, in which case the materials to be used shall be agreed between the interested parties.

Table 2 — Standard test formulations for evaluation of mercaptan-modified chloroprene rubbers^a

Material	Formulation A (parts by mass)	Formulation B (parts by mass)
Chloroprene rubber (CR), mercaptan-modified	100,00	100,00
Magnesium oxide ^b	4,00	4,00
Carbon black ^c	25,00	25,00
Zinc oxide ^d	5,00	5,00
MTT 80 in polymeric binder (curative) ^e	0,45	—
Sulfur	—	1,00
Di-ortho-tolyl guanidine (DOTG) ^f	—	1,00
<i>N</i> -cyclohexyl-2-benzothiazyl sulfenamide (CBS)	—	1,00
Total	134,45	137,00

^a The CR test formulation contains 3-methylthiazolidinethione-2 (MTT) (in the case of formulation A) or sulfur/DOTG/CBS (in the case of formulation B) instead of ethylene thiourea, a suspected carcinogen.

^b The surface area of the magnesium oxide shall be between 130 m²/g and 200 m²/g. Magnesium oxide absorbs water and carbon dioxide when exposed to air and this can affect its activity in compounds. Store it in a dry environment.

^c The current industry reference black (IRB), or an equivalent national or international standard reference material, shall be used.

^d Class B1a (see ISO 9298:1995, Annex D).

^e MTT 80 can be obtained from Rhein Chemie Rheinau GmbH, Mülheimer Str. 24-28, D-68219 Mannheim 81, Germany. This information is given for the convenience of users of this International Standard and does not constitute an endorsement by ISO of this product.

^f Under some conditions, DOTG might generate *o*-toluidine emissions classified as carcinogenic by the International Agency for Research on Cancer. Avoid exposure to emissions during curing of mixes.

6.2 Procedure

6.2.1 Equipment and procedure

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

6.2.2 Premastication

6.2.2.1 Weigh out 500 g of chloroprene rubber.

6.2.2.2 Adjust the mill-roll temperature to 50 °C ± 5 °C.

6.2.2.3 Band the rubber with a mill opening of 1,5 mm and start the timer at the instant the rubber is banded.

6.2.2.4 Adjust the nip to maintain a rolling bank of approximately 12 mm in diameter. Mill the rubber for 6 min, cutting as necessary to maintain a rolling bank and a tight band.

6.2.2.5 Remove the rubber from the mill and allow it to cool to room temperature prior to mixing.