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**Rubber — Standard reference  
elastomers (SREs) for characterizing  
the effect of liquids on vulcanized  
rubbers**

*Caoutchouc — Élastomères de référence normalisés (SRE) pour la  
caractérisation de l'effet des liquides sur les caoutchoucs vulcanisés*

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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 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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see [www.iso.org/directives](http://www.iso.org/directives)).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html). (standards.iteh.ai)

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This fourth edition cancels and replaces the third edition (ISO 13226:2011), which has been revised to incorporate the actual used ingredients, and their relevant influences on the test results.

## Introduction

The materials covered by this document are specified in [Annexes A](#) to [N](#).

The compounding and preparation ensure that the property profile agrees sufficiently with that of the material group represented, while the simple formulation ensures reliable reproducibility.

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# Rubber — Standard reference elastomers (SREs) for characterizing the effect of liquids on vulcanized rubbers

**WARNING 1** — Persons using this document should be familiar with normal laboratory practice. This document 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 determine the applicability of any national regulatory conditions.

**WARNING 2** — Certain procedures specified in this document might involve the use or generation of substances, or the generation of waste, that could constitute a local environmental hazard. Reference should be made to appropriate documentation on safe handling and disposal after use.

## 1 Scope

This document specifies requirements for vulcanized rubbers in sheet form for use as standards in characterizing the effect of test liquids and service fluids.

This document is not designed to provide formulations of elastomeric-product compositions for actual service.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 48, *Rubber, vulcanized or thermoplastic — Determination of hardness (hardness between 10 IRHD and 100 IRHD)*

ISO 1817, *Rubber, vulcanized or thermoplastic — Determination of the effect of liquids*

ISO 2230, *Rubber products — Guidelines for storage*

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

ISO 2781:2008, *Rubber, vulcanized or thermoplastic — Determination of density*

ISO 7619-1, *Rubber, vulcanized or thermoplastic — Determination of indentation hardness — Part 1: Durometer method (Shore hardness)*

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

## 3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>

## 4 Composition

The materials covered by this document are specified in [Annexes A to N](#), which are all normative.

The following standard reference elastomers are included:

- a) Acrylic rubbers:
  - SRE-ACM/1 and SRE-ACM/1X
- b) Acrylonitrile-butadiene rubbers:
  - SRE-NBR 28/P and SRE-NBR 28/PX
  - SRE-NBR 28/S, SRE-NBR 28/SX, SRE-NBR 34/S and SRE-NBR 34/SX
  - SRE-NBR/M
  - SRE-NBR/L
- c) Chlorobutyl rubbers:
  - SRE-CIIR/1
- d) Chloroprene rubbers:
  - SRE-CR/1
- e) Ethylene-propylene rubbers:
  - SRE-EPM/1
- f) Fluoropolymer rubbers:
  - SRE-FKM/1
  - SRE-FKM/2X
- g) Hydrogenated acrylonitrile-butadiene rubbers:
  - SRE-HNBR/1 and SRE-HNBR/1X
- h) Natural rubbers:
  - SRE-NR/1
- i) Silicone rubbers:
  - SRE-MQ/1
  - SRE-VMQ/1 and SRE-VMQ/1X

The materials shall be homogeneous mixes of the ingredients shown in the relevant annex, in the proportions shown, weighed to the accuracy required in ISO 2393.

All ingredients shall be of recognized rubber quality.

The identification of proprietary materials as suitable ingredients does not exclude the use of other materials that can be shown to meet the requirements of the standard.

If necessary, the quantity of carbon black or silica may be adjusted from one consignment of rubber to another to give properties within the limits specified in the annexes. If the filler content is adjusted, the details shall be declared.



## 5 Preparation

The mixing of compounds and the vulcanization of test sheets shall be carried out in accordance with ISO 2393 and, where appropriate, as modified by detailed conditions and procedures given in the annexes. If a mould release agent is needed, dry PTFE mould lubricant shall be used.

## 6 Description

The vulcanized test sheets shall be  $2 \text{ mm} \pm 0,2 \text{ mm}$  thick when measured in accordance with ISO 23529, and free from surface defects and internal voids when viewed with normally corrected vision.

A “lot” of sheets is those sheets made from a single batch of rubber mix vulcanized under the same conditions. A “pressing” is the quantity of sheets produced at the same time in a single moulding operation.

## 7 Test sheet properties

The test sheets shall be characterized by one or more physical properties in accordance with the relevant ISO standard test method. Properties and tolerances for individual materials are given in the annexes.

All sheets shall be tested for compliance with the requirements of [Clause 6](#). A sample sheet from each lot shall be tested for the properties of interest for compliance with the tolerances given in the appropriate annex. The actual values obtained shall be reported.

The test pieces necessary for determining material properties shall be taken from the test sheets in such a way that a minimum distance from the edge of the sheets is maintained. Dumb-bell test pieces shall be taken with their longitudinal axis parallel to the direction of milling of the moulding blank.

## 8 Designation

Each elastomer shall be designated as ISO 13226 SRE-A/B where ISO 13226 is this document, SRE is the abbreviation for standard reference elastomer and, after the hyphen, A is a set of code-letters designating the polymer type and B is a descriptor identifying the particular compound. Some designations end with the letter X to signify that additional test requirements apply.

## 9 Storage

Test sheets shall be stored in accordance with ISO 2230. After one year, they shall be retested or disposed of. If the sheets still meet the test requirements, they may be stored and used for a further year.

NOTE The yearly tests apply irrespective of the type of rubber used.

## Annex A (normative)

### Acrylic rubbers: SRE-ACM/1 and SRE-ACM/1X

#### A.1 Purpose

These SREs are representative of ACM materials such as the ones that are used, for instance, for parts in contact with petroleum products in the mechanical-engineering and automobile sectors.

They are used for the characterization of service fluids such as mineral oils, fuels, lubricants, hydraulic fluids, coolants and refrigerants with regard to their effect on vulcanized acrylic rubbers.

The changes in mass, volume, hardness, tensile strength and elongation at break of the SRE when in contact with the service fluid under specified conditions may be included as supplementary data in specifications for the fluid concerned.

#### A.2 Composition

The composition of the SREs for acrylic rubbers (SRE-ACM/1 and SRE-ACM/1X) is given in [Table A.1](#)<sup>1)</sup>.

**Table A.1 — Composition of the SREs**

Ingredients	Parts by mass
Acrylic rubber <sup>a</sup>	100,0
Stearic acid	1,0
Pentaerythrite stearate <sup>b</sup>	2,0
Octylated diphenylamine (ODPA) <sup>c</sup>	2,0
Carbon black, N550	65,0
Sodium stearate	4,0
Quaternary ammonium salts <sup>d</sup>	2,0
<b>Total</b>	<b>176,0</b>
<sup>a</sup> HyTemp 4051® from Zeon Chemicals L.P., or equivalent. <sup>b</sup> Struktol WB 222® from Schill & Seilacher, or equivalent. <sup>c</sup> Vulkanox OCD/SG® from Lanxess AG, or equivalent. <sup>d</sup> HyTemp NPC-50® from Zeon Chemicals L.P., or equivalent.	

#### A.3 Recommended mixing procedure

Mix on a two-roll mill (see [A.6](#)).

#### A.4 Vulcanization

Condition the sheeted compound at ambient temperature for 12 h to 48 h.

Press-cure at 180 °C ± 2 °C for 10 min ± 1 min.

1) Examples of products available commercially. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO of these products.

Post-cure at  $175\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$  for  $4\text{ h} \pm 0,5\text{ h}$ .

## A.5 Test sheet properties

SRE-ACM/1 material shall fulfil the basic property given in [Table A.2](#). Additional properties may be specified (see [Table A.3](#)).

SRE-ACM/1X material shall fulfil both the basic and the additional properties.

**Table A.2 — Basic property**

Property	Unit	Requirement	Test method
Increase in mass in test liquid B for fuels, as in ISO 1817	%	26 to 29	ISO 1817, three type 2 dumb-bell test pieces <sup>a</sup> immersed for $22\text{ h} \pm 0,5\text{ h}$ at $23\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ Test piece/test liquid volume ratio: $1/(30 \pm 5)$
<sup>a</sup> As specified in ISO 37.			

**Table A.3 — Additional properties in the initial state**

Property	Unit	Requirement	Test method
Tensile strength	MPa	12 to 16	ISO 37, five type 2 dumb-bell test pieces
Elongation at break	%	140 to 220	
Hardness	Shore A	69 to 74	ISO 7619-1, three type 2 dumb-bell test pieces <sup>a</sup> , three plies
	IRHD	69 to 74	ISO 48, three type 2 dumb-bell test pieces <sup>a</sup> , three plies
Density	Mg/m <sup>3</sup>	1,30 to 1,34	ISO 2781:2008, method A, three test pieces
<sup>a</sup> As specified in ISO 37.			

## A.6 Mixing procedures

The mixing procedure given in [Table A.4](#) can be used to produce SRE-ACM/1X material using a two-roll mill.

Table A.4 — Mixing on a two-roll mill

Roll diameter: 200 mm Working width: 395 mm Speed of rolls: 18/22 min <sup>-1</sup> Surface temperature of rolls: 70 °C ± 5 °C Mass of rubber: 650 g		
Mixing step	Elapsed time min	Nip opening mm
Band rubber	0	2,0 ± 0,5
Add stearic acid, pentaerythrite stearate, ODPA and carbon black	1	2,2 ± 0,5
Make 3/4 cuts (four from each side)	11	
Add sodium stearate and quaternary ammonium salts <sup>a</sup>	13	
Make 3/4 cuts (six from each side)	17	
Turn the rolled sheet (three times)	19	
Sheet off	21	
Final temperature of sheet: Approximately 75 °C		
<sup>a</sup> It is recommended that some of the final cuts be made during the addition of the sodium stearate to finalize the mixing procedure so that the sheet is taken off not later than 6 min ± 1 min after the accelerator has been added.		

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## Annex B (normative)

### Acrylonitrile-butadiene rubbers: SRE-NBR 28/P and SRE-NBR 28/PX

#### B.1 Purpose

These SREs are representative of peroxide-cured NBR materials such as are used, for instance, for parts in contact with petroleum products in the mechanical-engineering and automobile sectors.

They are used for the characterization of service fluids such as mineral oils, fuels, lubricants, hydraulic fluids, coolants and refrigerants with regard to their effect on vulcanized nitrile rubbers.

The changes in mass, volume, hardness, tensile strength and elongation at break of the SRE when in contact with the service fluid under specified conditions may be included as supplementary data in specifications for the fluid concerned.

#### B.2 Composition

The composition of SREs for acrylonitrile-butadiene rubbers (SRE-NBR 28/P and SRE-NBR 28/PX) is given in [Table B.1](#)<sup>2)</sup>.

**Table B.1 — Composition of the SREs**

Ingredients	Parts by mass
NBR with (28 ± 0,5) % by mass of acrylonitrile <sup>a</sup>	100,0
<i>N</i> -(1,3-dimethylbutyl)- <i>N'</i> -phenyl- <i>p</i> -phenylenediamine (6PPD) <sup>b</sup>	0,5
Zinc oxide, precipitated <sup>c</sup>	5,0
Carbon black, N550	70,0
Dicumyl peroxide (40 % by mass) <sup>d</sup>	3,0
<b>Total</b>	<b>178,5</b>
<sup>a</sup> Perbunan NT 2845® from Lanxess AG, or equivalent. <sup>b</sup> Vulkanox 4020® from Lanxess AG, or equivalent. <sup>c</sup> Zinkoxyd aktiv® from Lanxess AG, or equivalent. <sup>d</sup> Perkadox BC 40® from Akzo Nobel Chemicals B.V., or equivalent.	

#### B.3 Recommended mixing procedure

Prepare a masterbatch without the peroxide in an internal mixer followed by homogenizing and addition of peroxide on a two-roll mill (see [B.6.2](#)).

Alternatively, mix completely on a two-roll mill (see [B.6.3](#)).

2) Examples of products available commercially. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO of these products.