

---

International Standard



5794/2

---

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION

---

**Rubber compounding ingredients — Silica, precipitated, hydrated —  
Part 2 : Test recipe and determination of physical properties in rubber**

*Ingrédients de mélange du caoutchouc — Silices hydratées précipitées — Partie 2 : Formule d'essai et détermination des propriétés physiques dans le caoutchouc*

**iTeh STANDARD PREVIEW**  
**(standards.iteh.ai)**

First edition — 1982-11-15

[ISO 5794-2:1982](https://standards.iteh.ai/catalog/standards/sist/0032e910-3c25-4d0a-9347-29b4963857b0/iso-5794-2-1982)

<https://standards.iteh.ai/catalog/standards/sist/0032e910-3c25-4d0a-9347-29b4963857b0/iso-5794-2-1982>

---

UDC 546.284-31 : 678.023

Ref. No. ISO 5794/2-1982 (E)

Descriptors : rubber, styrene-butadiene rubber, silicon dioxide, tests, determination, physical properties, ingredients, test equipment.

## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (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 set up 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 5794/2 was developed by Technical Committee ISO/TC 45, *Rubber and rubber products*, and was circulated to the member bodies in February 1981.

(standards.iteh.ai)

It has been approved by the member bodies of the following countries :

Australia	Hungary	South Africa, Rep. of
Austria	India	Spain
Belgium	Italy	Sri Lanka
Brazil	Korea, Rep. of	Sweden
Canada	Mexico	Thailand
Czechoslovakia	Netherlands	United Kingdom
Egypt, Arab Rep. of	Poland	USA
France	Portugal	USSR
Germany, F. R.	Romania	

<https://standards.iteh.ai/catalog/standards/sist/0032e910-3c25-4d0a-9347-29b496385759/iso-5794-2-1982>

No member body expressed disapproval of the document.

# Rubber compounding ingredients — Silica, precipitated, hydrated —

## Part 2 : Test recipe and determination of physical properties in rubber

### 1 Scope and field of application

This part of ISO 5794 specifies the test recipe, equipment, procedure and test methods for determining the physical properties of precipitated hydrated silica in a styrene-butadiene rubber mix.

ISO 5794/1 describes methods for chemical analysis of precipitated hydrated silica, and ISO 5794/3 specifies its physical and chemical properties and properties in the rubber mix.

### 2 References

ISO 34, *Rubber, vulcanized — Determination of tear strength (trouser, angle and crescent test pieces)*.

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

ISO 48, *Vulcanized rubbers — Determination of hardness (Hardness between 30 and 85 IRHD)*.

ISO 289, *Rubber, unvulcanized — Determination of Mooney viscosity*.<sup>1)</sup>

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

ISO 3257, *Rubber compounding ingredients — Carbon black — Test recipe and method of evaluation in styrene-butadiene rubbers*.

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

ISO 5794, *Rubber compounding ingredients — Silica, precipitated, hydrated —*

*Part 1 : Non-rubber tests*.<sup>2)</sup>

*Part 3 : Specification*.<sup>2)</sup>

### 3 Test recipe

The standard test recipe is given in the following table.

Material	Reference material number	Parts by mass
SBR 1 500	EST <sup>1)</sup>	100,0
Silica		40,0
Zinc oxide	NBS 370d <sup>2)</sup>	3,0
Stearic acid	NBS 372g <sup>2)</sup>	1,5
TMTD <sup>3)</sup>	NBS 374c <sup>2)</sup>	2,0
TBBS <sup>4)</sup>	NBS 384 <sup>2)</sup>	2,0
Sulphur	NBS 371f <sup>2)</sup>	0,4
Total		148,9

<sup>1)</sup> See ISO 3257. A European equivalent to NBS standard reference material 386 has been developed by ANIC. This EST (European Standard Type) rubber is an SBR 1 500 type using a rosin acid emulsifier and a staining stabilizer.

<sup>2)</sup> NBS standard reference material number (National Bureau of Standards of the USA). Alternatively the ingredients shall be in accordance with equivalent national standards.

<sup>3)</sup> Tetramethylthiuramdisulphide.

<sup>4)</sup> *N-tert-butyl-2-benzothiazole sulphenamide*.

### 4 Procedure

#### 4.1 Equipment and procedure

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

#### 4.2 Mill mixing procedure

The standard laboratory mill batch mass, in grams, shall be based on four times the test recipe mass. The surface temperature of the rolls shall commence at  $30 \pm 5$  °C with proper cooling. The mass of the mixed batch shall not differ from the total mass of materials by more than 1,0 %.

1) At present at the stage of draft. (Revision of ISO/R 289-1963.)

2) At present at the stage of draft.

	<b>Duration</b> (min)
<b>4.2.1</b> Band the rubber with the mill opening set at 1,1 mm and make 3/4 cuts every 30 s from alternate sides .....	2
<b>4.2.2</b> Add the sulphur slowly and evenly across the rubber. When the sulphur has been incorporated, make one 3/4 cut from each side. ....	2
<b>4.2.3</b> Add the zinc oxide and approximately 10 % of the silica. No cuts shall be made at this stage.....	4
<b>4.2.4</b> Add the stearic acid and a further 10 % of the silica, again without cutting the batch.....	4
<b>4.2.5</b> Add the rest of the silica slowly. Adjust the mill opening so that the rolling bank has a diameter of approximately 15 mm. Do not cut during incorporation of the silica. Add the material from the pan and when all the silica is incorporated, cut once from each side .....	10
<b>4.2.6</b> Add the accelerator and make three 3/4 cuts from each side .....	4
<b>4.2.7</b> Cut the batch from the mill, set the mill opening to 0,8 mm and pass the rolled batch endwise through the rolls three times.....	2
<b>4.2.8</b> Allow the compound to run for 5 min on the mill with a suitable mill opening so that the rolling bank has a diameter of approximately 15 mm.....	5
<b>4.2.9</b> Sheet the batch to approximately 5 mm and check the mass of the batch.	_____
<b>Total time</b>	<b>33</b>
<b>4.2.10</b> Condition the batch for 18 to 24 h.	
<b>4.2.11</b> Remilling shall be performed in accordance with the following procedure.	
With the surface temperature of the rolls maintained at 30 ± 5 °C, set the mill opening to 0,2 mm and pass the batch once (without banding) through the rolls.	
Set the mill opening to approximately 3 mm. Band the mix and allow it to work with a good rolling bank for 5 min without cutting.	
Open the mill to give a minimum mix thickness of 6 mm and pass the mix through the mill four times, folding it back on itself each time.	
Take samples for the determination of vulcanization characteristics.	

Sheet the mix from the mill at such a setting as to obtain a finished thickness of approximately 2,2 mm for the preparation of the dumb-bell specimens (or another appropriate thickness for the preparation of the ring specimens).

Allow to stand for 2 h before vulcanizing.

### 4.3 Testing of the uncured mix

Determine the viscosity using the shearing disk viscometer in accordance with ISO 289.

## 5 Evaluation of vulcanization characteristics

### 5.1 Evaluation according to stress-strain properties

Vulcanize the test slabs at 145 °C or alternatively at 150 °C to optimum cure. Condition the vulcanized test slabs for 16 to 72 h.

Determine the tensile stress-strain properties (stress-strain at 500 %, tensile strength and elongation at break) in accordance with ISO 37.

Determine the hardness in accordance with ISO 48, and the tear strength in accordance with ISO 34.

### 5.2 Evaluation according to oscillating disc

Measure the following standard test parameters :

$M_L$ ,  $M_H$ ,  $t_{s1}$ ,  $t'_c(50)$  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

NOTE — Alternatively, macrodies may be used in which case a pre-heat of 1 min is necessary.

## 6 Precision

To be added later.