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Fifth edition
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Rubber, raw natural — Colour index test

Caoutchouc naturel brut — Essai d'indice de couleur

Reference number
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Foreword

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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).

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For an explanation of 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 www.iso.org/iso/foreword.html.

This document 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 4660:2011), which has been technically revised. The main changes compared to the previous edition are as follows:

— a colour spectrophotometer has been added as an alternative method to determine colour index in Clauses 1, 4 and in 5.8;

— the thickness of the material from the punch, in 5.4, has been specified to be 3,4 mm ± 0,2 mm;

— the weight of the test portion, in 6.1, has been specified to be 20 g ± 5 g;

— the number of pass for test piece preparation, in 6.1, has been specified to be two passes;

— the thickness of the final sheet from the mill, in 6.1, has been specified to be 1,7 mm ± 0,1 mm;

— the calibration for colour spectrophotometer has been added in 6.2;

— the procedure for colour determination using colour spectrophotometer has been added in 6.3.2;

— Method B using the colour spectrophotometer has been stated in Clause 1 as the preferred method.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Rubber, raw natural — Colour index test

WARNING — 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.

1 Scope

This document specifies two methods to determine the colour of raw natural rubber according to a standard colour scale:

— Method A: colour matching against standard coloured glasses;

— Method B: colour determination using colour spectrophotometer.

In case of dispute, the preferred method is Method B.

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

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:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

4 Principle

The raw rubber is prepared in the form of a moulded disc of specified thickness.

For Method A, the colour of this disc is compared and matched as closely as possible with that of standard glasses. Colour matching is carried out under diffuse daylight illumination against a matt white background, preferably by use of a comparator which suitably locates and shrouds the test piece and standard glass.

For Method B, the colour of the test piece is compared and matched automatically using a colour spectrophotometer.

Annex A gives additional information on comparison study between Method A and Method B.

5 Apparatus

The usual laboratory apparatus and, in particular, the following.

5.1 Laboratory mill, conforming to the requirements of ISO 2393.

5.2 Mould, of stainless steel or aluminium, 1,6 mm ± 0,05 mm thick, having cavities approximately 14 mm in diameter with two mould covers of similar material, 1 mm to 2 mm thick. A suitable mould is illustrated in Figure 1.

5.3 Platen press, capable of applying a pressure of not less than 3,5 MPa over the platen surfaces and maintaining platen temperatures of 150 °C ± 3 °C. Platens with lateral dimensions of 200 mm × 200 mm are suitable.

Dimensions in millimetres

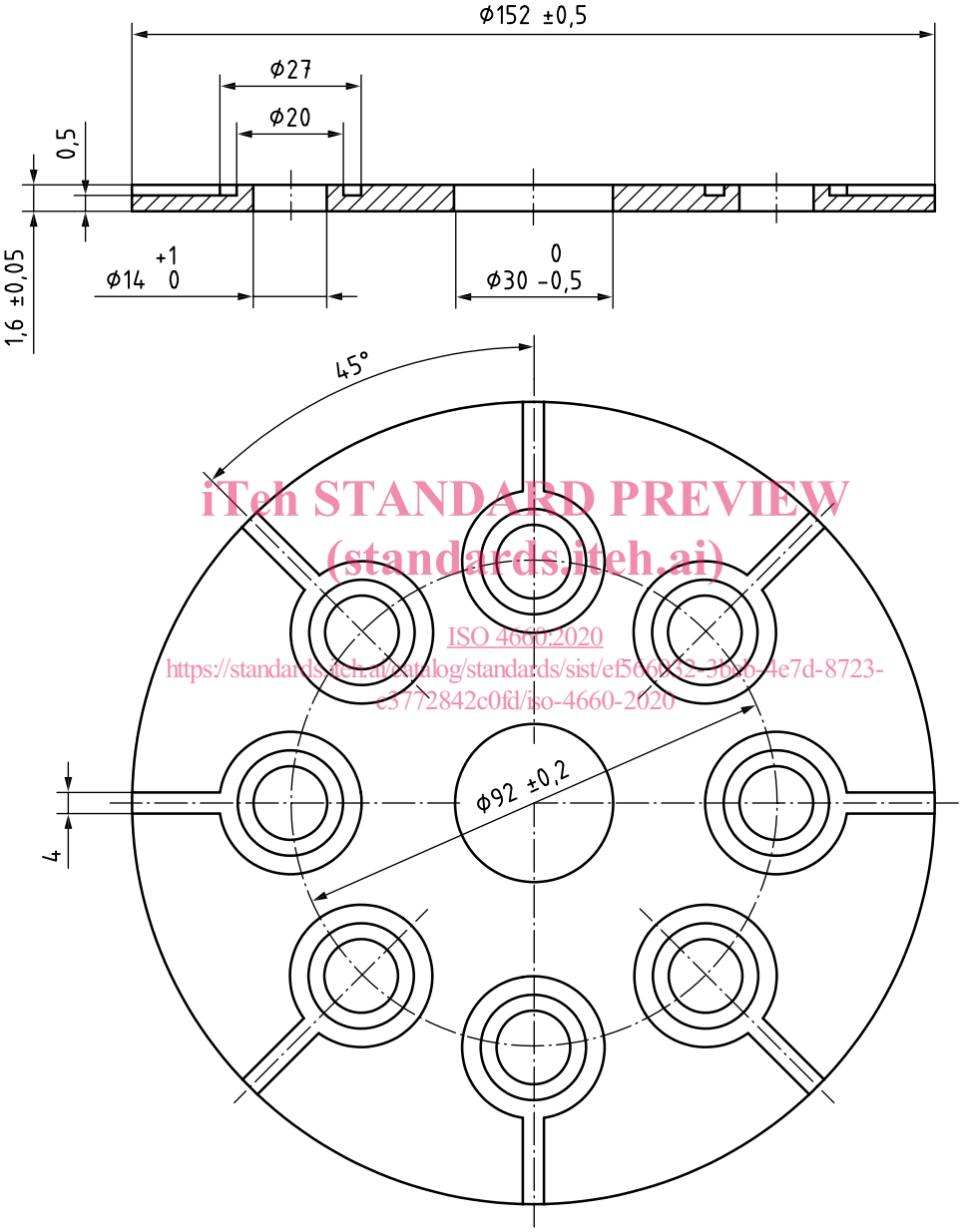


Figure 1 — Mould for colour index test

5.4 Punch, for preparation of the test pieces.

The purpose of the punch is to produce test pieces of approximately constant volume quickly and without difficulty. The punch shall consist of a flat-ended cylindrical anvil and a coaxial tubular knife

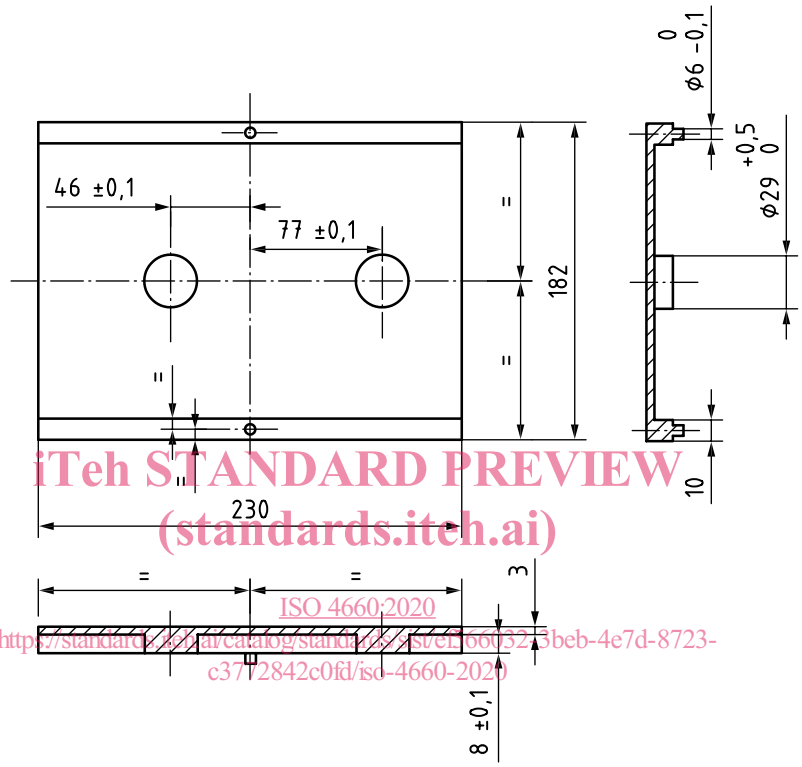
moving independently of one another; a single action of the handle shall compress a portion of the material to a thickness of 3,4 mm ± 0,2 mm and shall cut a disc of approximately 13 mm diameter.

NOTE This is identical with the test piece punch described in ISO 2007.

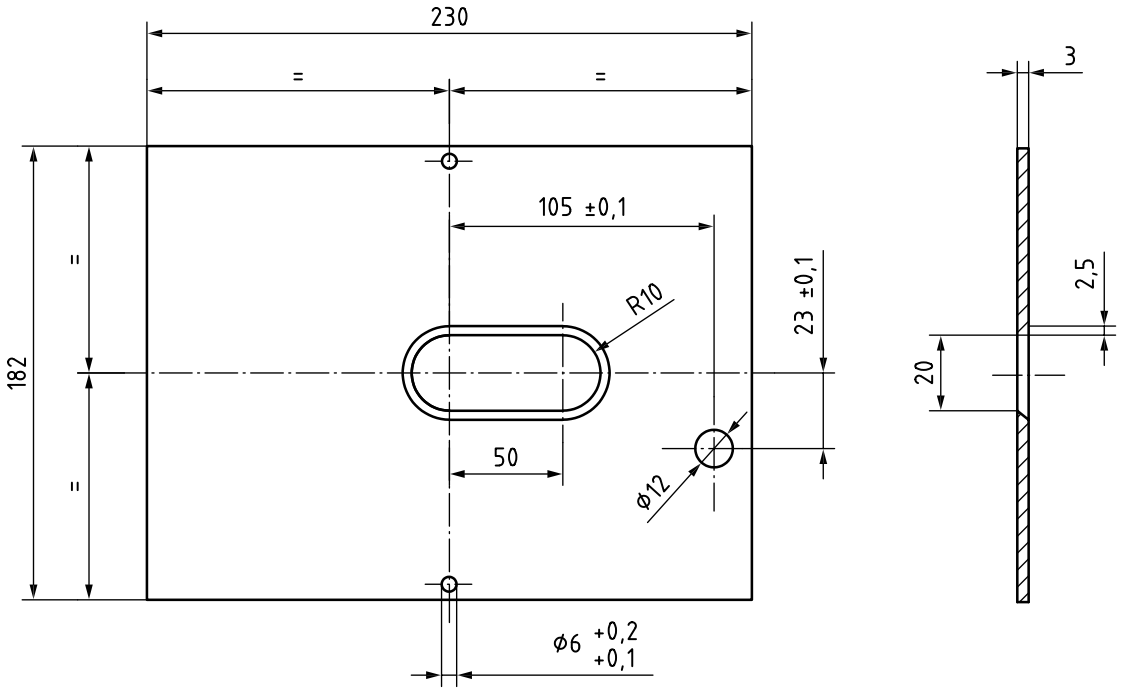
5.5 Transparent polyester or cellulose film, approximately 0,025 mm thick.

5.6 Comparator, as illustrated in Figure 2 or as available commercially.

Dimensions in millimetres



a) Base plate



b) Cover plate

Figure 2 — Comparator for use with commercial Lovibond Comparator discs

5.7 Standard coloured glasses, conforming to the requirements of Table 1 (colour index scale: 1 to 5 units in half-unit steps and 5 to 16 units in unit steps)[1]. The standard glasses are produced according to the intensity of amber colour to provide a colour index scale in which the higher index values correspond to darker colours.

Table 1 — Calibration table for standard glasses

Colour index	CIE[a] chromaticity coordinates using standard illuminant B[b]		
	x	*y*	*z*
1	0,357 7	0,368 6	0,275 2
1,5	0,362 9	0,372 8	0,265 5
2	0,367 2	0,377 0	0,255 8
2,5	0,373 8	0,380 4	0,245 8
3	0,377 6	0,385 5	0,236 9
3,5	0,384 2	0,389 6	0,226 2
4	0,388 0	0,393 5	0,218 5
4,5	0,392 5	0,397 9	0,211 0
5	0,396 5	0,400 3	0,203 2
6	0,405 0	0,408 9	0,186 1
7	0,414 1	0,412 4	0,173 6

[a] Commission Internationale de l'Éclairage (International Commission on Illumination).

[b] Standard illuminant B corresponds to the yellower phases of daylight (colour temperature 4 870 K).

1) These glasses are also referred to as Lovibond Comparator discs, 4/19A in 1 to 5 units and 4/19B in 5 to 16 units. They are supplied by Tintometer Limited, Lovibond House, Sun Rise Way Amesbury SP4 7GR, United Kingdom. Tel: +44(0)1980664800, Fax: +44(0) 1980625412. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO of the product named.

Table 1 *(continued)*

Colour index	CIE[a] chromaticity coordinates using standard illuminant B[b]		
	x	*y*	*z*
8	0,412 6	0,418 6	0,159 8
9	0,430 2	0,423 0	0,146 9
10	0,437 1	0,425 9	0,137 0
11	0,443 9	0,427 0	0,129 0
12	0,449 1	0,430 8	0,120 0
13	0,454 2	0,432 9	0,113 0
14	0,461 0	0,435 0	0,104 0
15	0,466 2	0,436 1	0,097 7
16	0,471 0	0,438 9	0,090 0

[a] Commission Internationale de l'Éclairage (International Commission on Illumination).

[b] Standard illuminant B corresponds to the yellower phases of daylight (colour temperature 4 870 K).

5.8 Colour spectrophotometer, automated colour measurement instruments that can measure the intensity of wavelengths in a spectrum of light compared with the intensity of light from a standard source (illuminant D65).

6 Procedure

6.1 Test piece preparation

Clean the mill (5.1) thoroughly and then proceed as follows:

Take a test portion of about 20 g ± 5 g from the homogenized piece and pass twice (doubling the sheet between passes) between the mill rolls, at room temperature and with the distance between the rolls adjusted so that the final sheet thickness is 1,7 mm ± 0,1 mm. Immediately double the sheet, which shall be uniform in texture and free from holes, and lightly press the two halves together by hand, avoiding the formation of air bubbles. From the doubled sheet (thickness of 3,4 mm ± 0,2 mm) cut two pellets with the test piece punch (5.4) and press them lightly together.

Press this test piece in the mould (5.2) between two sheets of polyester or cellulose film (5.5), with mould covers superimposed, at a pressure of not less than 3,5 MPa for 5 min ± 0,2 min at 150 °C ± 3 °C. Retain the test piece in the mould, with the transparent cover films attached, for testing. The moulded test piece shall be 1,6 mm ± 0,1 mm thick, excluding cover films, and shall be free from extraneous contaminants.

6.2 Calibration

The colour spectrophotometer shall be calibrated against the manufacturer's instructions. Different colour spectrophotometer may have different method of calibration.

6.3 Colour determination

6.3.1 Method A — Colour matching against standard coloured glasses

Compare the test piece with standard coloured glasses (5.7). Carry out the colour matching under diffuse daylight illumination against a matt white background, viewing in a direction normal to the major surface of the test piece. Take the colour index of the test piece as that of the glass giving the closest colour match.