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Specification

Raw natural rubber

Caoutchouc naturel brut

Naturrohgummi

British Standards Institution

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Contents

Foreword

This British Standard has been prepared under the authority of the Rubber Industry Standards Committee and is a revision of the 1968 edition.

In this revision the grade designation has been changed from letters to numbers based on the dirt content of the rubber and two new grades, 5L and 10, have been added, thus providing an extended range of rubbers with new grade codings, i.e. 2L, 5, 5L, 10, 20 and 50. Furthermore it has been possible to delete requirements on copper and manganese contents since the results of an international test programme have shown that the requirements in the specification on Plasticity Retention Index (PRI) adequately indicate any potential oxidizability of the raw rubber should harmful copper and/or manganese be present. For light coloured grades, 2L and 5L, a requirement on maximum Lovibond colour index has also been added.

This standard provides a means of specifying technical quality, and it caters for the compressed block forms of raw natural rubber. Block rubber is now more usually prepared by granulation (crumb) methods but it may also be prepared by the older methods of sheeting or creping. In using the standard it is necessary to specify the grade and then quote crumb (comminuted or castor oil treated), sheet or crepe. The specification has been devised to ensure controlled quality and maximum permissible levels of non-rubber constituents.

The standard agrees basically with ISO 2000 'Rubber, natural (NR) Specifications' prepared by Technical Committee TC 45 'Rubber and rubber products' of the International Organization for Standardization (ISO).

Points of difference are as follows.

(a) ISO 2000 does not cover the light coloured grades 2L and 5L.

(b) ISO 2000 does not contain requirements for bale mass and bale dimensions.

(c) ISO 2000 does not stipulate that the rubber shall be wrapped in polyethylene film.

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British Standard Specification

Raw natural rubber

1. Scope

This British Standard specifies requirements for six grades of general purpose raw natural rubber designated by the symbols 2L, 5, 5L, 10, 20 and 50. Raw natural rubber is available in crumb, sheet and crepe forms as specified by the purchaser.

2. References

The titles of the British Standards and Draft International Standard referred to in this standard are listed on the inside back cover.

3. Sampling

Raw natural rubber shall be sampled in accordance with BS 1673 : Part 1, or as agreed between the purchaser and the supplier.

4. Requirements

The rubber shall comply with the appropriate requirements given in table 1 with the additional requirement that grades 2L, 5 and 5L shall be prepared from deliberately coagulated latex only. Skim rubber shall not be added to raw rubber supplied in accordance with this specification.

5. Compliance

The lot shall be regarded as still complying with the requirements of this British Standard if only one bale of the sample fails to meet any one of the limits given in table 1 and if only one further bale of the sample fails to meet any other single limit.

Alternatively, the compliance requirements shall be as agreed between the purchaser and the supplier.

6. Packaging and marking

6.1 Bale mass and dimensions. The bale mass and dimensions shall be as follows.

(a) Bale mass : 33 $^1/_3$ kg net.
(b) Nominal major dimensions : 675 mm x 330 mm.

6.2 Wrapping. The bales shall be wrapped in polyethylene film prepared from commercial film grade polyethylene. The film shall be either thin, approximately 0.05 mm thickness, and dispersible in the rubber, or a thicker quality which may be stripped from the bales.

NOTE. A satisfactory quality of dispersable polyethylene has been found to have the following characteristics:

	Value	Test method
Nominal density	not greater than 0.92 g/cm^2	—
Melt flow index	2 to 7	BS 2782 : 1970 Method 105C
Melting point	less than 110 °C	BS 2782 : 1970 Method 103D

6.3 Grade colour coding. The wrapping shall be marked with the grade of rubber, in the following colours:

2L	Blue
5	Green
5L	Green
10	Brown
20	Red
50	Yellow

The indentification marker shall be of dispersible thin (approximately 0.05 mm thickness) polyethylene.

Table 1. Requirements for raw natural rubber

Characteristic	Limits for grade of rubber						Test method
	2L	5	5L	10	20	50	
Dirt, % *(m/m)*, retained on 45 µm sieve, max.	0.02	0.05	0.05	0.10	0.20	0.50	BS 1673 : Part 2
Plasticity retention index, min.	60	60	60	50	40	30	BS 1673 : Part 3
Rapid plasticity, min.	30	30	30	30	30	30	BS 1673 : Part 3
Volatile matter, % *(m/m)*, max.	1.00	1.00	1.00	1.00	1.00	1.00	BS 1673 : Part 2
Nitrogen, % *(m/m)*, max.	0.60	0.60	0.60	0.60	0.60	0.60	BS 1673 : Part 2
Ash, % *(m/m)*, max.	0.60	0.60	0.60	0.75	1.00	1.50	BS 1673 : Part 2
Lovibond colour index, max.	6	—	6	—	—	—	Appendix A

NOTE. Copper and manganese contents are not specified, but values for well prepared rubber would generally be as follows:

Copper	Less than 8 p.p.m. all grades
Manganese	Less than 10 p.p.m. grades 2L to 20
	Less than 20 p.p.m. grade 50

Appendix A

Method for the determination of Lovibond colour index

A.1 Principle. The raw rubber is prepared in the form of a moulded disc of specified thickness, and 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 pieces and standard glass.

The standard glasses used are calibrated according to the intensity of their colour (amber) to provide a colour index scale in which higher index values correspond to deeper colour.

This method corresponds to that described in ISO/DIS 4660.

A.2 Apparatus. The apparatus shall consist of the following.

A.2.1 *Standard coloured glasses* complying with the requirements of table 2 and constituting a colour index scale from 1 to 5 units in half-unit steps and from 5 to 16 units in single unit steps.

NOTE. These glasses are also referred to as Lovibond comparator discs, reference 4/19A for 1 to 5 units and reference 4/19B for 5 to 16 units, and are available commercially from Tintometer Limited, Salisbury, England.

A.2.2 *Laboratory mixing mill* complying with the requirements of BS 1674.

A.2.3 *Mould* of stainless steel or aluminium, 1.6 ± 0.05 mm thick, having cavities approximately 14 mm in diameter, plus two mould covers of similar material, 1 mm to 2 mm thick. A suitable mould is illustrated in figure 1.

A.2.4 *Platen press* capable of maintaining a pressure of not less than 3.5 MPa over the platen surfaces and platen temperatures of 150 ± 3 °C. Platens with lateral dimensions of 200 mm x 200 mm are suitable.

A.2.5 *Punch*: A punch shall be provided for the preliminary preparation of test pieces. The purpose of the punch is to produce pellets of approximately constant volume quickly and without difficulty. The punch shall comprise 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 approximately 3 mm in thickness and shall cut out a disc approximately 13 mm in diameter.

A.2.6 *Thickness gauge* *. The gauge shall have a scale graduated in unit divisions of 0.01 mm, shall be fitted with a flat contact of about 4 mm diameter, and shall operate with a pressure of 20 ± 3 kPa.

A.2.7 *Transparent polyester or cellulose film,* approximately 0.025 mm thick.

A.2.8 *Comparator* as illustrated in figure 2, or of similar performance as available commercially.

A.3 Procedure

A.3.1 *Sample preparation.* Homogenize the raw rubber as described in BS 1673: Part 1.

A.3.2 *Test piece preparation.* Take a test portion of about 30 g from the homogenized piece and pass it through the mill rolls three times, according to the procedure described in 3.6 of BS 1673 : Part 3 : 1969, doubling the sheet between passes to form a doubled sheet 3.2 mm to 3.6 mm thick. To prepare the test piece cut two pellets from the doubled sheet with the punch and laminate them lightly together.

Press this test piece into the mould between two sheets of polyester or cellulose film with mould covers superimposed at a pressure of not less than 3.5 MPa for 5 ± 0.2 min at 150 ± 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 ± 0.1 mm thick excluding cover films and free from extraneous contaminants.

A.3.3 *Colour determination.* Compare the colour of the test piece with the standard glasses. 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.

If the comparator shown in figure 2 is used, first place a sheet of matt white paper (with holes to accommodate the projections shown) on the base plate. Then fit the disc of standard glasses and the filled mould (with transparent cover films attached) over the projections and place the cover plate in position. Colour matching is then carried out.

A.4 Test report. Report the colour index of the rubber to the nearest half-unit for index values 1 to 5 and to the nearest unit for higher values.

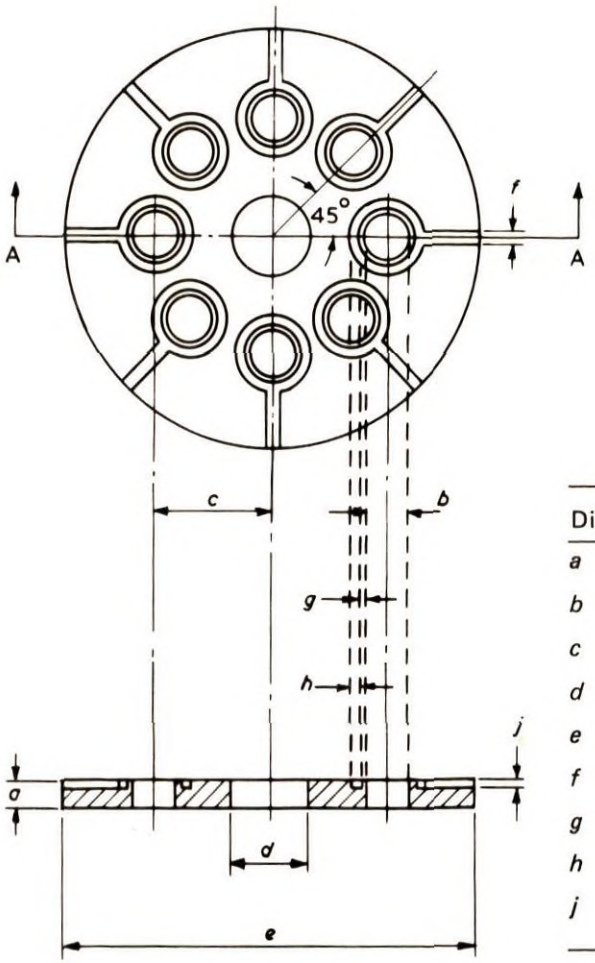
Very occasionally the colour of the rubber cannot be matched due to the presence of strong yellow or grey tints. In this case report that the colour index cannot be determined.

Table 2. Calibration table for standard glasses

Colour Index	CIE* chromaticity values using standard illuminant B		
	X	Y	Z
1	0.3577	0.3686	0.2752
1.5	0.3629	0.3728	0.2655
2	0.3672	0.3770	0.2558
2.5	0.3738	0.3804	0.2458
3	0.3776	0.3855	0.2369
3.5	0.3842	0.3896	0.2262
4	0.3880	0.3935	0.2185
4.5	0.3925	0.3979	0.2110
5	0.3965	0.4003	0.2032
6	0.4050	0.4089	0.1861
7	0.4141	0.4124	0.1736
8	0.4216	0.4186	0.1598
9	0.4302	0.4230	0.1469
10	0.4371	0.4259	0.1370
11	0.4439	0.4270	0.1290
12	0.4491	0.4308	0.1200
13	0.4542	0.4329	0.1130
14	0.4610	0.4350	0.1040
15	0.4662	0.4361	0.0977
16	0.4710	0.4389	0.0900

*Commission Internationale d'Eclairage. Standard illuminant B corresponds to the yellower phases of daylight (colour temperature 4870 K).

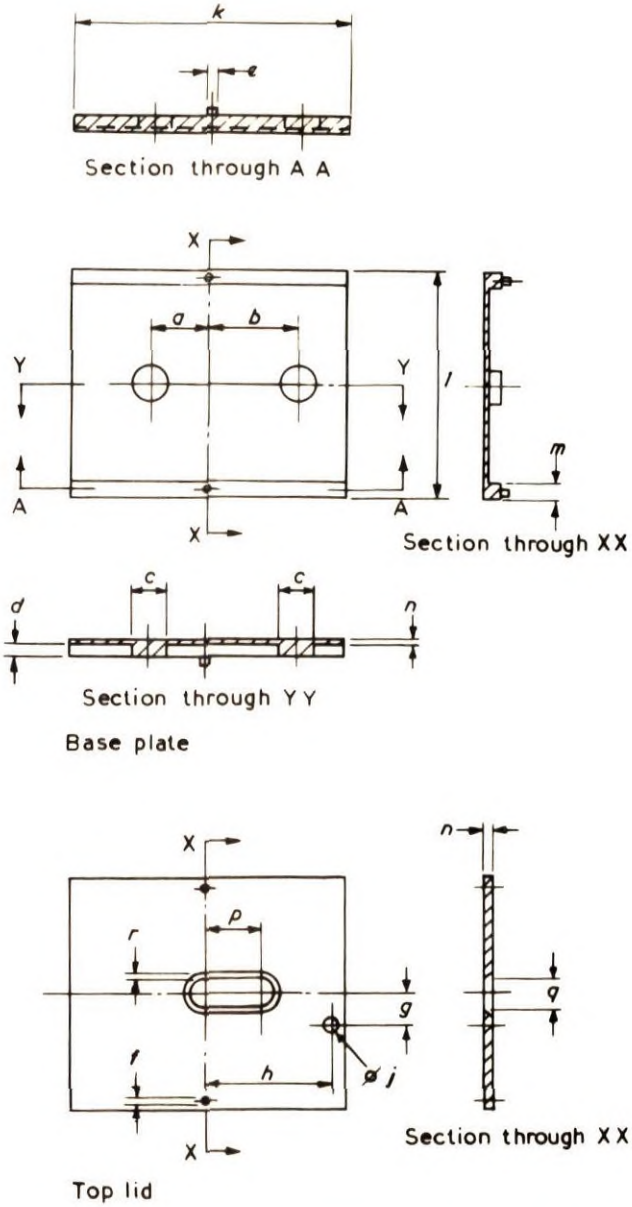
*As described in BS 903 : Part A2.



Dimension	mm
a	1.60 ± 0.05
b	$14 \pm {}^{1}_{0}$
c	46.0 ± 0.1
d	$30.0 \pm {}^{0.0}_{0.5}$
e	152 ± 0.5
f	4.0
g	3.0
h	3.5
j	0.5

Section through AA (not to scale).

Figure 1. Mould for colour index test



Dimension	mm
a	46.0 ± 0.1
b	77.0 ± 0.1
c	$29.0 \pm {}^{0.5}_{0}$
d	8.0 ± 0.1
e	$6.0 \pm {}^{0}_{0.1}$
f	$6.0 \pm {}^{0.2}_{0.1}$
g	23.0 ± 0.1
h	105 ± 0.1
j	12
k	230
l	182
m	10
n	3
p	50
q	20
r	2.5

Figure 2. Comparator for use with commercial Lovibond comparator discs

Publications referred to in this standard

This standard makes reference to the following British Standards and Draft International Standard:

BS 903 Methods of testing vulcanized rubber
Part A2 Determination of tensile stress-strain properties

BS 1673 Methods of testing raw rubber and unvulcanized compounded rubber
Part 1 Sampling and further preparative processes
Part 2 Chemical analysis of raw natural rubber
Part 3 Methods of physical testing

BS 1674 Equipment and procedures for mixing and vulcanizing rubber test mixes

BS 2782 Methods of testing plastics

ISO/DIS 4660 Rubber, natural (NR). Method for determination of colour index

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Contract requirements
Attention is drawn to the fact that this British Standard does not purport to include all the necessary provisions of a contract.

Revision of British Standards
British Standards are revised, when necessary, by the issue either of amendment slips or of revised editions. **It is important that users of British Standards should ascertain that they are in possession of the latest amendments or editions.**

The following BSI references relate to the work on this standard:
Committee reference RUC/27 Draft for comment 74/54284 DC

Co-operating organizations

The Rubber Industry Standards Committee, under whose supervision this British Standard was prepared, consists of representatives from the following Government departments and scientific and industrial organizations:

British Association of Synthetic Rubber Manufacturers
*British Rubber Manufacturers Association Ltd.
Department of Industry
*Malaysian Rubber Producers' Research Association
Ministry of Defence
Rubber and Plastics Research Association of Great Britain
*Rubber Growers' Association
Society of Motor Manufacturers and Traders Ltd.

The scientific and industrial organizations marked with an asterisk in the above list, together with the following, were directly represented on the committee entrusted with the preparation of this British Standard:

Tyre Manufacturers' Conference (Material Supplies Committee)
Individual experts

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Amendments issued since publication

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