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AMENDMENT 1
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Rubber, vulcanized or thermoplastic — Determination of density

AMENDMENT 1: Precision data

Caoutchouc vulcanisé ou thermoplastique — Détermination de la masse volumique

AMENDEMENT 1: Données de fidélité

Reference number
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Foreword

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Amendment 1 to ISO 2781:2008 was prepared by Technical Committee ISO/TC 45, *Rubber and rubber products*, Subcommittee SC 2, *Testing and analysis*.

Rubber, vulcanized or thermoplastic — Determination of density —

AMENDMENT 1: Precision data

Page 5

At the end of Clause 11, add the following new Clause 12:

"12 Precision

See Annex A."

Renumber the old Clause 12 as Clause 13.

At the end of the text

Add the following annex:

Annex A
(informative)

Precision

A.1 Background

An interlaboratory test programme (ITP) for the determination of the precision of the density measurement method specified in this International Standard was conducted in 2008 using the precision procedures and guidelines described in ISO/TR 9272:2005, *Rubber and rubber products — Determination of precision for test method standards*.

A.2 Details of ITP

A.2.1 A total of 15 laboratories participated in the ITP. However, test results were reported by only 13 of the laboratories. A total of four materials or compounds were used, designated compounds A, B, C and D in increasing magnitude of density from 0,97 to 1,86. The ITP was conducted over a period of four sequential weeks. On a specified day in each of these four weeks, five individual density measurements were made by each laboratory on each of the four materials. A test result was taken as the mean of the five individual measurements. The analysis of the data was conducted on the basis of these test results.

A.2.2 Two separate determinations of repeatability and reproducibility were conducted. The results from weeks 1 and 2 were used for repeatability and reproducibility evaluation No. 1 (i.e. these results were obtained by the typical day 1 vs day 2 test protocol specified in ISO/TR 9272). The results of weeks 3 and 4 were used in the same way for repeatability and reproducibility evaluation No. 2. The ISO/TR 9272:2005 option 1 outlier deletion procedure was used.

A.2.3 The precision results as determined by this ITP may not be applied to acceptance or rejection testing of any group of materials or products without documentation stating that the results of this precision evaluation actually apply to the products or materials tested.

A.3 Precision results

A.3.1 The precision results are given in Table A.1. General statements for the use of the precision results are also given. The results listed in Table A.1 are the mean results for evaluations 1 and 2 as indicated above (i.e. for all four weeks). These are given in terms of both the absolute precision, r and R, and the relative precision, (r) and (R).

A.3.2 *Repeatability:* The repeatability, or local domain precision, of the test method has been established for each material as the values given in Table A.1. Two individual test results (obtained by the proper use of this International Standard) that differ by more than the tabulated values of r, in measurement units, or (r), in percent, should be considered suspect, i.e. to have come from different populations. Such a decision suggests that appropriate investigative action be taken.

A.3.3 *Reproducibility:* The reproducibility, or global domain precision, for the test method has been established for each material as the values given in Table A.1. Two individual test results obtained in different laboratories (by the proper use of this International Standard) that differ by more than the tabulated values of R, in measurement units, or (R), in percent, should be considered suspect, i.e. to have come from different populations. Such a decision suggests that appropriate investigative action be taken.

Table A.1 — Precision results (type 1 precision)

Compound	Mean density	Within laboratory			Between laboratories			Number of laboratories[a]
		s_r	r	(r)	s_R	R	(R)	
A	0,966	0,001 86	0,005 21	0,54	0,002 47	0,006 91	0,72	10
B	1,223	0,001 19	0,003 34	0,27	0,001 8	0,005 04	0,41	12
C	1,366	0,000 93	0,002 61	0,19	0,002 02	0,005 65	0,41	11
D	1,857	0,001 16	0,003 25	0,17	0,002 15	0,006 02	0,32	11
Average value[b]		0,001 05	0,002 93	0,18	0,002 08	0,005 84	0,37	

Notation used:

s_r is the within-laboratory standard deviation (in measurement units);

s_R is the between-laboratory standard deviation (in measurement units);

r is the repeatability (in measurement units);

(r) is the repeatability (as a percentage of the mean value);

R is the reproducibility (in measurement units);

(R) is the reproducibility (as a percentage of the mean value).

[a] Number of laboratories after outliers deleted (total number of laboratories in ITP: 13).

[b] Simple averages calculated.

A.4 Additional comments

The absolute repeatability and reproducibility, r and R, values are essentially constant over the density range of 0,97 to 1,86. This results in a slight decrease in relative precision, (r) and (R), over this range. Consult Table A.1 for the actual values.

A.5 Bias

Bias is the difference between a measured average test result and a reference or true value for the measurement in question. Reference values do not exist for this test method and therefore bias cannot be determined.

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