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AMENDMENT 1
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Rubber, vulcanized or thermoplastic — Determination of stress relaxation in compression at ambient and at elevated temperatures

AMENDMENT 1: Precision data

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Caoutchouc vulcanisé ou thermoplastique — Détermination de la relaxation de contrainte en compression à température ambiante et aux températures élevées

AMENDEMENT 1: Données concernant la fiabilité

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Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this Amendment may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

Amendment 1 to International Standard ISO 3384:1999 was prepared by Technical Committee ISO/TC 45, *Rubber and rubber products*, Subcommittee SC 2, *Testing and analyses*.

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Rubber, vulcanized or thermoplastic — Determination of stress relaxation in compression at ambient and at elevated temperatures

AMENDMENT 1: Precision data

Pages 6 and 7

Add a new clause 10 entitled “Precision” as given below, renumber the existing clause 10 to become clause 11 and add the informative annex also given below.

10 Precision

10.1 General

An interlaboratory test programme (ITP) and the precision calculations to express the repeatability and reproducibility were performed in accordance with ISO/TR 9272:1986, *Rubber and rubber products — Determination of precision for test method standards*. Consult this for precision concepts and nomenclature. Annex A gives guidance on the use of repeatability and reproducibility results.

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10.2 Precision details

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10.2.1 The ITP was conducted in 1998. One material, an IR/SBR blend rubber compound, was used. Testing using method A was conducted at 23 °C and 100 °C and using method B at 100 °C. A test result is taken as the average value, for two test pieces, of the percent decrease in the initial counterforce after 168 h of relaxation. Twelve laboratories participated in the 23 °C testing using method A, eleven laboratories in the 100 °C testing using method A and seven laboratories in the 100 °C testing using method B.

10.2.2 The precision determined is a Type 1 precision; fully prepared test pieces were submitted to the laboratories. The precision is also an intermediate-term precision with a span of 2 or 3 weeks between the two replications. This is required due to the relaxation-ageing period of 168 h for each replication of the test. This is in distinction to the more usual day 1/day 2 replication with a few days between replications.

10.2.3 Analysis of the data from all the laboratories (all three tests) resulted in

— the results from three laboratories being declared outliers for method A at 23 °C;

— the results from two laboratories being declared outliers for method A at 100 °C;

— the result from one laboratory being declared an outlier for method B at 100 °C.

These results were rejected and the final analysis was conducted on the remaining data, viz:

— for method A at 23 °C: the results from nine laboratories;

— for method A at 100 °C: the results from nine laboratories;

— for method B at 100 °C: the results from six laboratories.

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The revised database represents those laboratories that had good within-lab control of the testing (the results are in relatively good agreement).

10.3 Precision results

The precision data obtained from the final database are given in Table 1. The precision (both repeatability and reproducibility) of method B at 100 °C is substantially worse than that for method A. No relative precision, (r) and (R), is given for this International Standard.

The symbols used in Table 1 are as follows:

s_r is the repeatability standard deviation, in measurement units;

r is the repeatability, in measurement units (i.e. % relaxation);

s_R is the reproducibility standard deviation, in measured units;

R is the reproducibility, in measurement units (i.e. % relaxation).

Table 1 — Precision results

Method A, 168 h at 23 °C					
Material	Mean % relaxation	s_r	r	s_R	R
A	10,9	0,795	2,22	1,21	3,40
Method A, 168 h at 100 °C					
Material	Mean % relaxation	s_r	r	s_R	R
A	50,5	0,845	2,37	2,15	6,03
Method B, 168 h at 100 °C					
Material	Mean % relaxation	s_r	r	s_R	R
A	67,5	2,07	5,8	8,66	24,3

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Annex A
(informative)

Guidance for using precision results

A.1 The general procedure for using precision results is as follows, with the symbol $|x_1 - x_2|$ designating a absolute difference in any two measurement values (i.e. without regard to sign).

A.2 Enter the appropriate precision table (for whatever test parameter is being considered) at an average value (of the measured parameter) nearest to the "test" data average under consideration. This line will give the applicable r, (r), R or (R) for use in the decision process.

A.3 With these r and (r) values, the following general repeatability statements may be used to make decisions.

A.3.1 For an absolute difference: the difference $|x_1 - x_2|$ between two test (value) averages, found on nominally identical material samples under normal and correct operation of the test procedure, will exceed the tabulated repeatability r on average not more than once in twenty cases.

A.3.2 For a percentage difference between two test (value) averages: The percentage difference

$$\frac{x_1 - x_2}{\frac{1}{2}(x_1 + x_2)} \times 100$$

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between two test values, found on nominally identical material samples under normal and correct operation of the test procedure, will exceed the tabulated repeatability (r) on average not more than once in twenty cases.

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A.4 With these R and (R) values, the following general reproducibility statements may be used to make decisions.

A.4.1 For an absolute difference: the absolute difference $|x_1 - x_2|$ between two independently measured test (value) averages, found in two laboratories using normal and correct test procedures on nominally identical material samples, will exceed the tabulated reproducibility R not more than once in twenty cases.

A.4.2 For a percentage difference between two test (value) averages: The percentage difference

$$\frac{x_1 - x_2}{\frac{1}{2}(x_1 + x_2)} \times 100$$

between two independently measured test (value) averages, found in two laboratories using normal and correct test procedures on nominally identical material samples, will exceed the tabulated reproducibility (R) not more than once in twenty cases.

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