Australian Standard®

Methods of test for elastomers

Method 26: Rubber, vulcanized—Accelerated ageing or heat-resistance tests

PREFACE

This Standard was prepared by the Standards Australia Committee on Analysis and Testing of Elastomers under the direction of the Joint Multitechnics Standards Policy Board.

It is technically equivalent to ISO 188:1982, *Rubber, vulcanized—Accelerated ageing or heat-resistance tests*.

For the purposes of this Australian Standard, the ISO text should be modified as follows:

(a) *Terminology* The words 'Australian Standard' should replace the words 'International Standard' wherever they appear.

(b) *Decimal marker* Substitute a full point (.) for a comma (,) as a decimal marker.

(c) *Other modifications* The following amendments should be made to the ISO text:

(i) In Clause 1, a Note should be added as follows:

NOTE: This method may be applied to thermoplastic elastomers and thermoplastic materials other than elastomers.

(ii) Clause 2 should be entitled 'References' and the following additional references included:

AS 1683	Methods of test for elastomers
AS 1683.11	Method 11: Tension testing of vulcanized rubber
AS 1683.15.1	Method 15.1: International rubber hardness
AS 1683.15.2	Method 15.2: Durometer hardness
AST[illegible] E145	Standard specification for gravity-convection and forced-ventilation ovens

(iii) In Clauses 3.1 and 4.1, in the first paragraph, the word '(modulus)' should be added after 'elongation' and the words 'in accordance with AS 1683.11, AS 1683.15.1 and AS 1683.15.2' should be added at the end of the paragraph.

(iv) In Clause 3.2.1, the existing text of the third paragraph starting with 'Provision shall . . . . ' should be deleted and the following text substituted:

'Provision shall be made for circulation of air through the cells of not less than one change per hour'.

(v) In Clause 3.2.1, in the fifth paragraph, '±1°C, ±2°C or ±3°C' should be substituted for '±1°C or ±2°C'.

(vi) In Clause 3.2.1, a Note should be included at the end of the sixth paragraph, as follows:

NOTE: In certain circumstances, it may be necessary for a specific air circulation rate to be used.

(vii) In Clause 3.2.2, the existing text of the second paragraph starting with 'Provision shall . . . . ' should be deleted and the following text substituted:

'Provision shall be made for circulation of air through the oven of not less than one change per hour'.

(viii) In Clause 3.2.2, in the fourth paragraph, '±1°C, ±2°C or ±3°C' should be substituted for '±1°C or ±2°C'.

(ix) In Clause 3.2.2, two Notes should be added at the end of the fifth paragraph, as follows:

NOTES:

1 In certain circumstances, it may be necessary for a specific air circulation rate to be used.

2 One suitable method for determining circulation rate is specified in ASTM E145, under the heading 'Rate of ventilation'.

(x) In Clauses 3.4 and 4.4 the following words should be added to the end of the existing text:

'unless otherwise specified in a referring Standard'.

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0 Introduction

Accelerated ageing or heat-resistance tests are designed to estimate the relative resistance of rubber vulcanizates to deterioration with the passage of time. For this purpose, the rubber is subjected to controlled deteriorating influences for definite periods, after which appropriate properties are measured and compared with the corresponding properties of the unaged rubber.

The purpose of the test may be to assess the deterioration of the rubber either

a) during prolonged periods at normal or high temperatures in air; or

b) during use at elevated temperatures and at elevated oxygen pressure.

Two types of test method are given in this International Standard, namely

a) air-oven methods (using a cell-type oven or a normal oven);

b) oxygen pressure method.

The selection of the time, temperature and atmosphere to which the test pieces are exposed will depend on the purpose of the test and the type of polymer.

In the air-oven tests, deterioration is accelerated by raising the temperature and, in the oxygen pressure test, by increasing the oxygen concentration and the temperature. The degree of acceleration thus produced varies from one vulcanizate to another and from one property to another.

Consequences of this are

a) Accelerated tests do not truly reproduce under all circumstances the changes produced by natural ageing.

b) Accelerated tests sometimes fail to indicate accurately the relative natural or service life of different rubbers; thus, tests at temperatures greatly above ambient or service temperatures may tend to equalize the apparent life of rubbers which deteriorate at different rates in storage or service. Tests at one or more intermediate temperatures are useful in assessing the reliability of accelerated ageing at high temperatures.

c) Accelerated tests involving different properties may not agree in assessing the relative merits of different rubbers and may even arrange them in different orders of merit. Therefore, deterioration should be measured by the changes in property or properties which are of practical importance, provided that they can be measured reasonably accurately.

Attention is drawn to the fact that air-oven and oxygen pressure ageing tests should not be used to simulate natural ageing which occurs in the presence of either light or ozone when the rubbers are stretched.

1 Scope and field of application

This International Standard specifies two types of accelerated ageing or heat-resistance tests on vulcanized rubbers, namely air-oven methods (using either a cell-type oven or a normal oven) and oxygen pressure method.

2 Reference

ISO 1826, *Rubber, vulcanized — Time-interval between vulcanization and testing — Specification*.

3 Accelerated ageing by heating in air

3.1 Principle

Tests pieces are subjected to controlled deterioration by air at an elevated temperature and at atmospheric pressure, after which the physical properties are measured and compared with those of unaged test pieces. The physical properties concerned in the service application are used to measure the deterioration, but in the absence of any statement of these properties, it is recommended that tensile strength, stress at intermediate elongation, breaking elongation and hardness be measured.

In this test, the oxygen concentration is low, and if oxidation is rapid, oxygen may not diffuse into the rubber quickly enough to maintain uniform oxidation. The test is therefore liable to give misleading results with poor-ageing rubbers, when the normal thickness specified in the International Standard appropriate to the test method is used.