

Australian Standard™

AS 1683.26

Methods of test for elastomers**Method 26: Rubber, vulcanized or thermoplastic—
Accelerated ageing and heat resistance tests**

PREFACE

This Standard was prepared by the Standards Australia Committee RU-003, Analysis and Testing of Elastomers to supersede AS 1683.26—1994 *Methods of test for elastomers Method 26: Rubber, vulcanized—Accelerated ageing or heat-resistance tests*.

The objective of this Standard is to provide manufacturers and users of elastomeric materials with a method for accelerated ageing and heat resistance tests as vulcanized or thermoplastic rubbers.

This Standard is identical with and has been reproduced from ISO 188:1998, *Rubber, vulcanized or thermoplastic—Accelerated ageing and heat resistance tests*.

The term ‘informative’ has been used in this Standard to define the application of the annex to which it applies. An ‘informative’ annex is only for information and guidance.

As this Standard is reproduced from an international Standard, the following applies:

- (a) Its number appears on the cover and title page while the International Standard number appears only on the cover.
- (b) In the source text, ‘this International Standard’ should read ‘this Australian Standard’.
- (c) A full point substitutes for a comma when referring to a decimal marker.

References to international Standards should be replaced by equivalent Australian Standards as follows:

<i>Reference to International Standard</i>		<i>Australian Standard</i>	
ISO		AS	
37	Rubber, vulcanized or thermoplastic— Determination of tensile stress-strain properties	1683 1683.11	Methods of test for elastomers Method 11: Tension testing of vulcanized rubber
48	Rubber, vulcanized or thermoplastic— Determination of hardness (hardness between 10 IRHD and 100 IRHD)	1683.15.1	Method 15.1: International rubber hardness
471	Rubber—Temperatures, humidities and times for conditioning and testing	1683.20	Method 20: Standard temperatures, humidities and times for conditioning and testing
11346	Rubber, vulcanized or thermoplastic— Estimation of life-time and maximum temperature of use from an Arrhenius plot	—	



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WARNING – Persons using this International Standard should be familiar with normal laboratory practice. This standard 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 and to ensure compliance with any national regulatory conditions.

1 Scope

This International Standard specifies accelerated ageing or heat resistance tests on vulcanized or thermoplastic rubbers. The methods are:

Method A: air-oven method using a cell-type oven or cabinet oven with low air speed and a ventilation of 3 to 10 changes per hour;

Method B: air-oven method using a cabinet oven with forced air circulation by means of a fan and a ventilation of 3 to 10 changes per hour; and

Method C: oxygen pressure method at 2,1 MPa and 70 °C.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 37:1994, *Rubber, vulcanized or thermoplastic – Determination of tensile stress-strain properties.*

ISO 48:1994, *Rubber, vulcanized or thermoplastic – Determination of hardness (hardness between 10 IRHD and 100 IRHD).*

ISO 471:1995, *Rubber – Temperatures, humidities and times for conditioning and testing.*

ISO 11346:1997, *Rubber, vulcanized or thermoplastic – Estimation of life-time and maximum temperature of use from an Arrhenius plot.*

3 Principle

Test pieces are subjected to controlled deterioration by air at an elevated temperature and at atmospheric pressure (for 3.1 and 3.2) or at an elevated temperature and an elevated oxygen pressure (for 3.3), after which the physical properties are measured and compared with those of unaged test pieces.

The physical properties concerned in the service application should be used to determine the degree of deterioration but, in the absence of any indication of these properties, it is recommended that tensile strength, stress at intermediate elongation, elongation at break (in accordance with ISO 37) and hardness (in accordance with ISO 48) be measured.

3.1 Accelerated ageing by heating in air

In this method, the oxygen concentration is low and, if oxidation is rapid, oxygen may not diffuse into the rubber quickly enough to maintain uniform oxidation. This ageing method 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.

3.2 Heat resistance test

In this method, the test pieces are subjected to the same temperature as they would experience in service and, after definite periods, appropriate properties are measured and compared with those of the unaged rubber.

3.3 Accelerated ageing by heating in oxygen

In this method, the increased oxygen concentration promotes rapid diffusion and so helps to ensure uniform oxidation. On the other hand, the artificial promotion of oxidation may overemphasize oxidative changes relative to those caused by after-vulcanization, e.g. reversion, so that the total effect may not resemble that of natural ageing.

4 Apparatus

4.1 Air oven (for 3.1 and 3.2)

To achieve a good precision when doing ageing and heat resistance tests, it is very important to keep the temperature uniform and stable during the test and to verify that the oven used is within the temperature limits with regard to time and space. Increasing the air speed in the oven improves temperature homogeneity.

However, air circulation in the oven and ventilation influence the ageing results. With a low air speed, accumulation of degradation products and of evaporated ingredients, as well as oxygen depletion, can take place. A high air speed increases the rate of deterioration, due to increased oxidation and volatilization of plasticizers and antioxidants.

The oven shall be of such a size that the total volume of the test pieces does not exceed 10 % of the free space in the oven. Provision shall be made for suspending test pieces so that they are at least 10 mm from each other and, in cabinet ovens and ovens with forced air circulation, at least 50 mm from the sides of the oven.

The temperature of the oven shall be controlled so that the temperature of the test pieces is kept within the specified tolerance for the specified ageing temperature (see clause 7) for the whole ageing period. A temperature sensor shall be placed inside the heating chamber to record the actual ageing temperature.

No copper or copper alloys shall be used in the construction of the heating chamber.

For the ovens specified in 4.1.1 and 4.1.2, provision shall be made for a slow flow of air through the oven of not less than three and not more than ten air changes per hour. The air speed shall depend on the air change rate only, and no fans are allowed inside the heating chamber.

Care shall also be taken to ensure that the incoming air is heated to within ± 1 °C of the temperature of the oven before coming in contact with the test pieces.

The ventilation (or air change rate) can be determined by measuring the volume of the oven chamber and the flow of air through the chamber.

4.1.1 Cell-type oven, consisting of one or more vertical cylindrical cells having a minimum height of 300 mm. The cells shall be surrounded by a thermostatically controlled good-heat-transfer medium (aluminium block, liquid bath or saturated vapour). Air passing through one cell shall not enter other cells.

4.1.2 Cabinet oven, comprising a single chamber without separating walls.

4.1.3 Oven with forced air circulation, with an air speed of 0,5 m/s to 1,5 m/s. The air flow through the heating chamber shall be as uniform and laminar as possible. The test pieces shall be placed with the smallest surface facing towards the air flow direction to avoid disturbing the air flow.