

International Standard



4665/2

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**Rubber, vulcanized — Resistance to weathering —
Part 2: Methods of exposure to natural weathering***Caoutchouc vulcanisé — Résistance aux intempéries — Partie 2: Méthodes d'exposition aux agents atmosphériques***First edition — 1985-09-15****UDC 678.063 : 620.193.2****Ref. No. ISO 4665/2-1985 (E)****Descriptors :** rubber, vulcanized rubber, tests, environmental tests, determination, weather resistance.**Documents**Document Sharing Hub
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Foreword

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Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 4665/2 was prepared by Technical Committee ISO/TC 45, *Rubber and rubber products*.

Rubber, vulcanized — Resistance to weathering — Part 2: Methods of exposure to natural weathering

0 Introduction

Weathering tests of the type specified in this part of ISO 4665 are needed to evaluate the performance of materials intended for outdoor use. The results of such tests should be regarded only as an indication of the effect of weathering. Results obtained at one time may not be strictly comparable with those obtained at another, although, in general, samples exposed for any period of several years and examined at the same time of year will show comparable behaviour. Even in long-term tests, the results may be affected by the season in which the tests are started.

The results of short-term exposure tests can give an indication of the relative outdoor performance but should not be used to predict the absolute long-term performance of a material. The results of tests carried out for less than 12 months will depend on the particular season of the year in which they are commenced.

It should be noted that the method of exposure is usually designed to expose the material to the most severe effects associated with any particular climate. It should therefore be borne in mind that the severity of exposure in actual use is, in most cases, likely to be less than that specified in this part of ISO 4665, and allowance should be made accordingly when interpreting the results. For example vertical exposure is considerably less severe in its effect on rubbers, particularly in tropical regions, where the sun is at a high angle when it is most powerful, and also because rain-water drains more rapidly from test pieces.

In the northern hemisphere, north-facing surfaces are likely to be less severely degraded than south-facing ones because they are less exposed to solar radiation, but the fact that they may remain wet for longer periods may be of significance for materials that are affected by moisture.

1 Scope and field of application

This part of ISO 4665 specifies methods of exposing vulcanized rubbers to natural weathering in order to assess changes produced after specified stages of such exposure.

It includes procedures designed for estimating the resistance of rubber to ozone cracking under atmospheric conditions of exposure.

NOTE — For the method of determination of changes in properties after exposure, see ISO 4665/1.

2 References

ISO 105, *Textiles — Tests for colour fastness*

Section A02, *Grey scale for assessing change in colour.*

Section B01, *Colour fastness to light: Daylight.*

ISO 471, *Rubber — Standard temperatures, humidities and times for the conditioning and testing of test pieces.*

ISO 1431/1, *Rubber, vulcanized — Resistance to ozone cracking — Part 1: Static strain test.*

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

ISO 4661, *Rubber — Preparation of test pieces.*

ISO 4665/1, *Rubber, vulcanized — Resistance to weathering — Part 1: Assessment of changes in properties after exposure to natural weathering or artificial light.*

3 Principle

Exposure outdoors to natural daylight of test pieces, or if required sheets and other shapes from which test pieces can later be cut. After a given exposure stage, removal for the determination of changes in colour, appearance or mechanical properties. The exposure stage may be a given interval of time or expressed in terms of a given solar radiation dosage. The latter is preferred whenever the main objective of the exposure is to determine resistance to light ageing since it minimizes the effect of variations in the quality and intensity of solar radiation with climate, location and time.

Unless otherwise specified, test pieces for the determination of change in colour and change in mechanical properties are exposed in an unstrained state. If required they may be exposed under window glass. Test pieces for the determination of ozone resistance are exposed under one or more tensile strains and are examined for cracking at certain intervals. Ozone resistance is expressed according to the procedures given in ISO 1431/1.

Climatic conditions and variations during the test are monitored and reported with other conditions of exposure.

4 Apparatus

4.1 Exposure equipment, consisting essentially of a test rack on to which test pieces may be mounted directly or in suitable holders.

The rack, holders and other fixtures shall be made from inert materials that will not affect the test results. Wood, non-corrosive aluminium alloy, stainless steel or ceramics have been found suitable. Materials having thermal properties which differ from these may give different results.

Brass, steel or copper shall not be used in the vicinity of the test pieces. Where test pieces are to be exposed in the strained condition, the apparatus shall be made of a material which does not readily decompose ozone (aluminium is a suitable material).

The design of the rack shall be suited to the types of test pieces being tested, but for many purposes a flat frame mounted on a support is suitable. This frame shall consist of rails of wood or other approved materials to which the test pieces may be secured. When installed, the rack shall be capable of giving the desired angle of inclination (see 6.1) and shall be such that no portion of the test pieces shall be closer than 0,5 m to the ground or any other obstruction.

For tests under strain, the test piece holder shall secure the test piece at the required elongation. In the case of unstrained test pieces, fixtures shall be secure but should apply as little stress as possible to the test pieces and permit shrinkage, expansion or warping to occur without constraint, so far as possible.

When backing is necessary to support the test pieces, it shall be of an inert material. Also it shall be so designed that there is no pronounced sagging of the test piece, but it shall be able to support the test piece with a minimum of contact with its underside, to prevent retention of rain-water. In such cases, fine strand wire netting may be used.

If exposure under glass is required, the rack shall be placed in a suitable open-bottomed box covered with a framed lid of glass. The lid should have an unobstructed area greater than that of the rack to avoid shading. It is also recommended that there is sufficient space between the lid and the rack to ensure adequate ventilation; 75 mm has been found suitable.

The glass used for the lid shall be flat, uniformly transparent and without defects. For most purposes, a glass of 3 mm thickness, having a transmittance of approximately 90 % from 370 to 380 nm in the visible range of the spectrum, and a transmittance of less than 1 % at 300 to 310 nm and shorter wavelengths, is recommended. To maintain these characteristics it is usually necessary to replace the glass at intervals of not more than 2 years.

NOTE — Exposure under glass may give rise to different results compared to exposure to the open atmosphere because of a difference between under glass and open air temperature.

4.2 Apparatus for measurement of climatic factors, appropriate to the method adopted.

NOTE — See 7.2 for equipment required for the determination of radiation dosage.

5 Test piece

5.1 Form and preparation

The dimensions of the test piece shall normally be those specified in the appropriate test method for the property or properties to be measured after exposure. For some tests, the exposed test piece may also be in the form of a sheet or other shape from which test pieces can later be cut for specific tests.

As far as possible each test piece shall be cut from freshly moulded sheet or, if required, from a finished product in accordance with ISO 4661. It shall have an undamaged test surface, and, when used to measure ozone resistance, shall not have a test surface that has been cut or buffed.

Only test pieces of similar dimensions and having approximately the same exposed areas shall be compared.

5.2 Number of test pieces

The number of test pieces for each test condition or exposure stage shall be that specified in the appropriate test method for the property or properties to be measured after exposure.

The total number of test pieces required will be determined by the number of exposure stages.

5.3 Storage and conditioning

For all test purposes, the minimum time between vulcanization and testing shall be 16 h in accordance with ISO 1826.

For non-product tests, the maximum time between vulcanization and testing shall be 4 weeks and for evaluations intended to be comparable the test, as far as possible, should be carried out after the same time interval.

For product tests, whenever possible, the time between vulcanization and testing should not exceed 3 months. In other cases, tests shall be made within 2 months of the date of receipt of the product by the customer.

Test sheets and test pieces shall not, at any time, be allowed to come into contact with those of a different composition. This is necessary in order to prevent additives which may affect resistance to weathering, such as antioxidants, from migrating from one vulcanizate into adjacent vulcanizates.

For tests intended to determine the resistance of rubber to ozone cracking, test pieces may be conditioned in the strained state prior to exposure. This is often desirable in order to allow the development of the protective wax bloom before exposure. In such cases, after stretching the test pieces to the desired test strain (see 6.3), the test pieces shall be conditioned for a period of between 48 and 96 h in an essentially ozone-free atmosphere in the dark; the temperature for this conditioning shall normally be the standard laboratory temperature (see ISO 471), but other temperatures may be used if appropriate for particular applications. The test pieces shall not be touched or otherwise disturbed in any way during the conditioning period. For tests intended to be comparable, the conditioning time and temperature shall be the same.