

Rubber, vulcanized or thermoplastic — Resistance to ozone cracking —

Part 3: Reference and alternative methods for determining the ozone concentration in laboratory test chambers

ICS 83.060

National foreword

This British Standard reproduces verbatim ISO 1431-3:2000 and implements it as the UK national standard.

The UK participation in its preparation was entrusted to Technical Committee PRI/22, Physical testing of rubber, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this committee can be obtained on request to its secretary.

Cross-references

The British Standards which implement international publications referred to in this document may be found in the BSI Standards Catalogue under the section entitled “International Standards Correspondence Index”, or by using the “Find” facility of the BSI Standards Electronic Catalogue.

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Summary of pages

This document comprises a front cover, an inside front cover, the ISO title page, pages ii to v, a blank page, pages 1 to 21 and a back cover.

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**Rubber, vulcanized or thermoplastic —
Resistance to ozone cracking —**

**Part 3:
Reference and alternative methods for
determining the ozone concentration in
laboratory test chambers**

*Caoutchouc vulcanisé ou thermoplastique — Résistance au craquelage par
l'ozone —*

*Partie 3: Méthode de référence et autres méthodes pour la détermination
de la concentration d'ozone dans les enceintes d'essai de laboratoire*



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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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 part of ISO 1431 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 1431-3 was prepared by Technical Committee ISO/TC 45, *Rubber and rubber products*, Subcommittee SC 2, *Physical and degradation tests*.

ISO 1431 consists of the following parts, under the general title *Rubber, vulcanized or thermoplastic — Resistance to ozone cracking*:

- *Part 1: Static strain test*
- *Part 2: Dynamic strain test*
- *Part 3: Reference and alternative methods for determining the ozone concentration in laboratory test chambers*

Annexes A, B and C form a normative part of this part of ISO 1431.

Introduction

A number of techniques exist for the analysis of gaseous ozone/air mixtures used for ozone crack testing of rubbers. These include wet-chemical procedures, electrochemical cells, UV absorption and chemiluminescence with ethylene.

In principle, the wet-chemical, electrochemical and UV absorption methods are all absolute, but in practice they do not in general yield the same results.

Wet-chemical methods, which usually consist of the absorption of ozone in a potassium iodide solution and titration of the iodine released with sodium thiosulfate, were traditionally used in the rubber industry and were specified in national standards. They are not suitable for continuous operation or control and hence are less desirable in practice than instrumental methods. The results obtained have been shown to be sensitive to small variations in test procedures and the concentration and purity of reagents, and there has been much controversy over the stoichiometry of the reaction.

Electrochemical methods are widely used in the rubber industry and found to be convenient in continuously monitoring and controlling ozone. Chemiluminescence methods have also been used.

More recently, UV absorption analysers, which have the same monitoring and controlling ability, have been increasingly used. Most important, this technique has been adopted by all major environmental agencies as the standard and is regarded by them to be absolute.

Consequently, this standard UV absorption method is adopted as the reference technique against which all others must be calibrated. Like any measurement instrument, the accuracy of any particular UV instrument is dependent on the calibration and maintenance of its components, and hence even UV analysers should be checked against acknowledged standard instruments. Studies are being undertaken in several countries to propose a primary-standard apparatus.

Although this part of ISO 1431 is concerned with ozone analysis, it also draws attention to the influence of atmospheric pressure on the rate of cracking of rubber at constant ozone concentrations as normally expressed in terms of parts by volume. As established by interlaboratory tests conducted in North America^[3], the variation in ozone resistance that can result between laboratories operating at significantly different atmospheric pressures can be corrected by specifying ozone concentration in terms of the partial pressure of ozone (see annex C).

Attention is drawn to the highly toxic nature of ozone. Efforts should be made to minimize the exposure of workers at all times. In the absence of more stringent or contrary national safety regulations, it is recommended that 10 parts of ozone per hundred million parts of air of the surrounding atmosphere by volume be regarded as an absolute maximum concentration, whilst the maximum average concentration should be appreciably lower.

Unless a totally enclosed system is being used, an exhaust vent to remove ozone-laden air is recommended.

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1 Scope

This part of ISO 1431 describes three types of method for the determination of ozone concentration in laboratory test chambers.

Method A — UV absorption: this is the reference method, and is used as the means of calibration for the alternative methods B and C.

Method B — Instrumental techniques:

B1: electrochemical

B2: chemiluminescence

Method C — Wet-chemical techniques:

Procedure I

Procedure II

Procedure III

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 1431. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 1431 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 1431-1:1989, *Rubber, vulcanized or thermoplastic — Resistance to ozone cracking — Part 1: Static strain test.*

ISO 1431-2:1994, *Rubber, vulcanized or thermoplastic — Resistance to ozone cracking — Part 2: Dynamic strain test.*

ISO 13964:1998, *Air quality — Determination of ozone in ambient air — Ultraviolet photometric method.*