

ICS 83.060
CCS G 40



**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

GB/T 20028-2026

Replacing GB/T 20028-2005

**Rubber, vulcanized or thermoplastic - Estimation of life-time
and maximum temperature of use**

硫化橡胶或热塑性橡胶 寿命和最高使用温度的推算

(English Translation)

Issued on: July 2, 2026

Implemented on: February 1, 2027

Issued by: State Administration for Market Regulation

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Foreword

This document complies with the provisions of GB/T 1.1-2020 "Standardization Work Guidelines Part 1: Structure and Drafting Rules of Standardization Documents".

Drafting.

This document replaces GB/T 20028-2005 "Application of Vulcanized Rubber or Thermoplastic Rubber. Arrhenius Diagram Estimation of Service Life and Maximum Service Value".

Compared with GB/T 20028-2005, the main technical changes in "Using Temperature" are as follows, except for structural adjustments and editorial modifications.

- a) The scope has been changed (see Chapter 1, Chapter 1 of the 2005 edition);
- b) Added terms and definitions for "lifetime at a given temperature", "lifetime under a given time-temperature combination", and "aging factor".

(See 3.1.1, 3.1.2 and 3.2);

- d) The description of critical value selection has been changed (see Chapter 6, Chapter 6 of the 2005 edition);

- e) Added provisions regarding the number of test samples (see Chapter 7);

- f) The requirement for aging intervals has been removed (see Chapter 7 of the 2005 edition);

- g) Added provisions for selecting test temperature intervals (see Chapter 8);

- h) The provisions regarding the time required for the minimum and maximum temperatures to reach the critical values have been removed (see 8.2 in the 2005 edition);

- i) A provision for "trial time" has been added (see Chapter 9);

- j) The requirement for a "thermal aging chamber" has been removed (see Chapter 9 of the

2005 edition);

k) Added provisions for outlier checking (see Chapter 10);

l) The method for analyzing the results of the Arrhenius method was changed (see 11.1, Chapter 11 of the 2005 edition).

m) A method for analyzing the results of the WLF method has been added (see 11.2);

n) Added restrictions to the results analysis (see 11.3).

This document adopts ISO 11346:2023 "Estimation of life and maximum service temperature of vulcanized or thermoplastic rubber".

The following minimal editorial changes have been made to this document.

---Added warning message;

---Added explanation of the coefficient of determination R^2 (see Chapter 4);

--- An expression for the ratio of aging time t at temperature T to aging time t_0 at reference temperature T_0 has been added (see 11.2).

Please note that some content in this document may involve patents. The issuing organization of this document assumes no responsibility for identifying patents.

This document was proposed by the China Petroleum and Chemical Industry Federation.

This document is under the jurisdiction of the National Technical Committee on Standardization of Rubber and Rubber Products (SAC/TC35).

Materials Research Institute, Shandong Linglong Tire Co., Ltd., Sailun Group Co., Ltd., Shandong Yanggu Huatai Chemical Co., Ltd.

Tianjin Rubber Industry Research Institute Co., Ltd., Jiangyin Haida Rubber & Plastics Co., Ltd., Harbin Saisang Sealing Technology Co., Ltd., Anhui Zhong Ding Sealing Parts Co., Ltd., Qingdao Borui Zhiyuan Vibration Reduction Technology Co., Ltd., Suzhou Jianrui Electronic Machinery Co., Ltd., Qingdao Aotai Transportation Equipment Co., Ltd., Shenyang Rubber Research and Design Institute Co., Ltd., Beijing Huateng Testing and Certification Co., Ltd., Anhui Longrun Polymer Materials Co., Ltd.

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Introduction

Chemical reaction rates generally increase with increasing temperature. By treating samples under different high-temperature conditions, aging rates can be established.

The relationship between the rate and temperature is used to extrapolate the degree of aging after a certain time at a specified temperature, or to determine the degree of aging

after reaching a specified aging level.

The time required for the process.

The relationship between reaction rate and temperature is typically described using the Arrhenius equation. The reaction rate at a given temperature can be expressed by this equation.

The selected performance is determined by how it changes with exposure time at a given temperature. The reaction rate can be expressed as the time to reach a specified degree of degradation (critical value).

This suggests that when the performance-temperature relationship is complex, this may be the only practical approach.

The Arrhenius method is only applicable to chemical degradation reactions. For tests where it is difficult to separate physical (viscoelastic) changes from chemical changes, it is not suitable.

It can lead to incorrect conclusions.

For rubber materials, the Williams-Randall-Ferry equation (WLF equation) can be used as an alternative method. This equation is applicable to materials that achieve...

This principle can be applied to any physical property, including permanent deformation and stress relaxation, as well as situations where the property has a complex time relationship. (Related information) for specific applications of the WLF equation, please refer to reference [1].

vulcanized rubber or thermoplastic rubber Calculation of lifespan and maximum operating temperature Warning 1---Personnel using this document must have practical experience working in a formal laboratory. This document does not specify all possible safety precautions.

Regarding all issues, users are responsible for taking appropriate safety and health measures and ensuring compliance with relevant national regulations.

Warning 2---Some steps outlined in this document may involve the use or generation of certain wastes, which may pose a hazard to the local environment.

The relevant documents should include appropriate provisions for safe operation and disposal of waste after use.

1 Scope

This document describes the principles and procedures for estimating the thermal aging life of rubber based on the results of long-term high-temperature exposure tests.

The document describes two methods.

---One method uses the Arrhenius equation;

---Another approach uses the WLF equation.

In this document, the estimated thermal aging life is based solely on the changes in selected properties after high-temperature exposure. Because the various properties of rubber change with thermal aging...

Since the rates of change during the aging process are different, the thermal aging life of different rubbers can only be compared using the same performance index.

2 Normative references

The contents of the following documents, through normative references within the text, constitute essential provisions of this document. Dated citations are not included.

For references to documents, only the version corresponding to that date applies to this document; for undated references, the latest version (including all amendments) applies.

This document.

3 Terms and Definitions

The following terms and definitions apply to this document.

life-time

The test material achieves the specified performance characteristics under conditions closest to actual operating temperature or time-temperature combination (for outdoor applications).

The time at the critical value (3.4).

3.1.1

The time is obtained by extrapolating a straight line to a given operating temperature (e.g., 25°C).

3.1.2

Lifetime under a given time-temperature combination the lifetime is obtained by dividing the lifetime at a given temperature (3.1.1) (i.e., the lifetime at the reference temperature) by the aging factor (3.2).