

Translated English of Chinese Standard: GB/T27800-2021
www.ChineseStandard.net → Buy True-PDF → Auto-delivery.
Sales@ChineseStandard.net

GB

NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA

ICS 83.140.50

CCS G 43

GB/T 27800-2021

Replacing GB/T 27800-2011

**Determination of the life for static sealing rubber
products**

静密封橡胶制品使用寿命的快速预测方法

Issued on: May 21, 2021

Implemented on: December 01, 2021

Issued by: State Administration for Market Regulation;

**Standardization Administration of the People's Republic of
China.**

Table of Contents

Foreword.....	3
1 Scope.....	5
2 Normative references.....	5
3 Terms and definitions	6
4 Principle	6
5 Specimen	6
6 Test instruments.....	7
7 Test conditions	7
8 Test steps.....	8
9 Result processing	9
10 Test report.....	14
Annex A (informative) Suggestions on the upper limit of temperature for accelerated aging test of different kinds of rubber materials	15
Annex B (informative) Derivation of the relationship between the aging coefficient y and the aging time t and the test temperature T	16

Determination of the life for static sealing rubber products

1 Scope

This Standard specifies the fast-forecasting method to determine the service life of static sealing rubber products.

This Standard is applicable to determine the service life of static sealing rubber products in the state of compression (radial compression is 12%-25%, axial compression is 15%-40%) when in contact with various media and air. It is also applicable to determine the storage period of rubber products in free state.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

GB/T 528, *Rubber, vulcanized or thermoplastic - Determination of tensile stress-strain properties*

GB/T 1683, *Rubber, vulcanized - Determination of compression set at constant strain*

GB/T 1685, *Rubber, vulcanized or thermoplastic - Determination of stress relaxation in compression at ambient and at elevated temperatures*

GB/T 1690, *Rubber vulcanized or thermoplastic - Determination of the effect of liquids*

GB/T 3512, *Rubber, vulcanized or thermoplastic - Accelerated ageing and heat resistance tests - Air-oven method*

GB/T 5720, *Test methods for rubber O-rings*

GB/T 7759.1, *Rubber, vulcanized or thermoplastic - Determination of compression set - Part 1: At ambient or elevated temperatures*

GB/T 15905, *Rubber, vulcanized - Test method of damp heat aging*

6 Test instruments

6.1 Hot air aging box

The hot air aging box shall meet the requirements of GB/T 3512.

6.2 Humidity test chamber

The humidity test chamber shall meet the requirements of GB/T 15905.

6.3 Tensile testing machine

The tensile testing machine shall meet the requirements of GB/T 528.

6.4 Compressive stress relaxation instrument

The compressive stress relaxation instrument shall meet the requirements of GB/T 1685.

7 Test conditions

7.1 Test temperature

7.1.1 The number of aging test temperature shall not be less than 5. The interval between adjacent temperatures is not less than 10°C.

7.1.2 The upper limit of the test temperature varies with the raw rubber and vulcanization system. Refer to Table A.1 in Annex A for the recommended upper limit of test temperature. When the test time allows, lower the test temperature to improve the accuracy of prediction.

7.2 Test humidity

Consider the accelerated aging test under the influence of relative humidity. The relative humidity during the test is consistent with the relative humidity in the use environment.

7.3 Test time

7.3.1 There shall be no less than 10 test data at each test temperature. The time interval can be determined according to the performance changes. For compression set, the difference between the two test results is controlled within 10%. For stress relaxation and elongation at break, the difference between the two test results shall be controlled within 10% of the original value.

7.3.2 At the first performance test at each test temperature, the change in

8.2.2 Determination of compression set

8.2.2.1 The compression set is determined in accordance with GB/T 7759.1. After compressing the specimen to the specified compression rate, place in a standard laboratory environment for 3d. Then open the fixture. Place for another 1d. Determine the height and it shall be the initial height. After the specimen has been subjected to the accelerated aging test (see 8.1), remove the fixture from the aging box and remove the load. Place for 1d under standard laboratory conditions. Measure and record the height of the specimen. Calculate its compression set.

8.2.2.2 Put the specimen back into the fixture and return it to the aging box for the next cycle of aging. Measure, record and calculate the compression set again. Repeat this for many times.

8.2.2.3 For the test of 3 higher temperatures among 5 temperatures, when the compression set reaches the critical value (see 9.6.1) or greater than 70%, terminate the test. For the other two lower temperature tests, when the compression set is greater than 50%, terminate the test.

8.2.3 Determination of elongation at break

8.2.3.1 The elongation at break is measured in accordance with GB/T 528. The elongation at break before aging is the average of the results of 10 dumbbell-shaped specimens. After the specimen has been subjected to the accelerated aging test (see 8.1), the elongation at break is the average of the results of 5 dumbbell-shaped specimens. Record the elongation at break for all aging cycles.

8.2.3.2 For the test of 3 higher temperatures among 5 temperatures, when the elongation at break reaches the critical value (see 9.6.1) or less than 30% of the original value, terminate the test. For the other two lower temperature tests, when the elongation at break should be less than 50% of the original value, terminate the test.

9 Result processing

9.1 Relationship between the aging coefficient y and the aging time t and the test temperature T

The relationship between the aging coefficient y and the aging time t and the test temperature T can be described by formula (1):

$$\log \left[-\log \left(\frac{y}{B} \right) \right] = b_0 + b_1 \log t + b_2 \frac{1}{T} \quad \dots\dots\dots (1)$$

$$\hat{Y}_{\max} = X_0 \hat{\beta} + t_{1-\frac{\alpha}{2}} (n-2-1) \cdot \hat{\sigma} \cdot \sqrt{1 + X_0' (X'X)^{-1} X_0} \quad \dots\dots\dots (10)$$

Where,

n - Points of test data;

α - Confidence level;

$\hat{\sigma}$ - Residual standard deviation.

Substitute formula (10) into formula (9) to obtain a given aging temperature and aging time. The maximum performance change of y under the confidence level $1-\alpha$ is shown in formula (11):

$$\hat{y} = B \times 10^{\left\{ -10 \left[X_0 \hat{\beta} + t_{1-\frac{\alpha}{2}} (n-2-1) \cdot \hat{\sigma} \cdot \sqrt{1 + X_0' (X'X)^{-1} X_0} \right] \right\}} \quad \dots\dots\dots (11)$$

9.6 Determination of service life

9.6.1 Determination of threshold value

9.6.1.1 The threshold value is determined by an assessment test that simulates the use conditions of static sealing rubber products. Choose a suitable temperature from the test temperature. Accelerate the aging of static sealing rubber products and standard samples at the selected temperature. Through the functional simulation test of rubber sealing products, find the aging time of the loss of sealing performance of static sealing rubber products. According to the performance change of the standard specimen at this time, determine the threshold value y_0 for the failure of static sealing rubber products.

9.6.1.2 The threshold value can also be the limit allowable value of the relevant performance stipulated in the technical conditions of static sealing rubber products.

9.6.2 Determination of service life

The maximum performance change of y after different aging times at a given aging temperature and confidence level $1-\alpha$ can be calculated according to formula (11). Try to input a different aging time. When the calculated maximum performance change value of y is just the aging time t of the threshold value y_0 , it shall be the service life of static sealing rubber products at a given temperature.

This is an excerpt of the PDF (Some pages are marked off intentionally)

Full-copy PDF can be purchased from 1 of 2 websites:

1. <https://www.ChineseStandard.us>

- SEARCH the standard ID, such as GB 4943.1-2022.
- Select your country (currency), for example: USA (USD); Germany (Euro).
- Full-copy of PDF (text-editable, true-PDF) can be downloaded in 9 seconds.
- Tax invoice can be downloaded in 9 seconds.
- Receiving emails in 9 seconds (with download links).

2. <https://www.ChineseStandard.net>

- SEARCH the standard ID, such as GB 4943.1-2022.
- Add to cart. Only accept USD (other currencies - <https://www.ChineseStandard.us>).
- Full-copy of PDF (text-editable, true-PDF) can be downloaded in 9 seconds.
- Receiving emails in 9 seconds (with PDFs attached, invoice and download links).

Translated by: Field Test Asia Pte. Ltd. (Incorporated & taxed in Singapore. Tax ID: 201302277C)

About Us (Goodwill, Policies, Fair Trading...): <https://www.chinesestandard.net/AboutUs.aspx>

Contact: Wayne Zheng, Sales@ChineseStandard.net

Linkin: <https://www.linkedin.com/in/waynezhengwenrui/>

----- The End -----