GB

RAILWAY INDUSTRIAL STANDARD OF THE

PEOPLE'S REPUBLIC OF CHINA

ICS 45.060.01
S 31

TB/T 2843-2007

Replacing TB/T 2843-1997, TB/T 2589-1995

General technical specification for elastic parts for railways

机车车辆用橡胶弹性元件通用技术条件

Issued on: December 30, 2007 **Implemented on: May 01, 2008**

Issued by: Ministry of Railways of the People's Republic of China

Table of Contents

Foreword 3

1 Scope 5

2 Normative references 5

3 Classification 7

4 Environmental requirements 7

5 Basic performances and requirements 7

6 Test methods 12

7 Inspection rules 13

8 Marking, packaging, storage and transportation 15

Annex A 16

Annex B 21

Annex C 26

Annex D 30

Annex E 34

Bibliography 39

Foreword

This Standard non-equivalently adopts European standard EN 13913-2003 “Elastic Basic Components of Rubber Suspension Parts for Railways” and Japanese industrial standard JIS E 4710-1995 “General Rules on Rubber Vibration Isolators for Railway Rolling Stock”.

Main differences between this Standard and EN 13913-2003 are as follows:

- Dynamic creep test and test method are not specified;

- Static or dynamic stress relaxation test and test method are not specified.

Main differences between this Standard and JIS E 4710-1995 are as follows:

- Hardness test and test method are not specified;

- Insulation resistance test and test method are not specified.

This Standard replaces TB/T 2843-1997 “General technical specification for elastic parts for railways” and TB/T 2589-1995 “General Technical Conditions for Rubber Pads for Electric Locomotives”.

Compared with TB/T 2843-1997 and TB/T 2589-1995, the main changes of this Standard are as follows:

- Basic performances and requirements of elastic rubber parts are different;

- ADD dynamic performance test of elastic rubber parts;

- ADD static creep test of elastic rubber parts;

- Static performance, adhesive performance, fatigue performance and other product test methods of elastic rubber parts are different.

Annexes A, B, C, D and E of this Standard are normative.

This Standard was proposed by and shall be under the jurisdiction of Ministry of Railways Institute of Standards and Metrology.

Drafting organizations of this Standard: Zhuzhou Times New Material Technology Co., Ltd. AND Metals & Chemical Research Institute of China Academy of Railway Sciences.

Main drafters of this Standard: Wang Jin, Zhao Xiyong, Liu Guojun, Lin Dawen, Mao Kunpeng and Yang Weijian.

The previous versions replaced by this Standard are as follows:

- TB/T 2843-1997;

- TB/T 2589-1995.

General Technical Specifications for Elastic Parts for Railways

1 Scope

This Standard specifies classification, basic performances, requirements, test methods, inspection rules, marking, packaging, storage and transportation of elastic rubber parts for railways.

This Standard applies to elastic rubber parts for shock absorption, buffer, flexible connection, limiting, etc. in hanging system, equipment installation system, connection, limiting positions, etc. of railways.

This Standard does not apply to air springs, sealed rubber products, coupler buffers, hoses and conveyor belts of railways.

2 Normative references

The provisions in following documents become the provisions of this Standard through reference in this Standard. For dated references, the subsequent amendments (excluding corrigendum) or revisions do not apply to this Standard, however, parties who reach an agreement based on this Standard are encouraged to study if the latest versions of these documents are applicable. For undated references, the latest edition of the referenced document applies.

GB/T 228-2002 Metallic materials - Tensile testing at ambient temperature (ISO 6892:1998(E), EQV)

GB/T 528-1998 Rubber, vulcanized or thermoplastic - Determination of tensile stress-strain properties (eqv ISO 37 - 1994)

GB/T 529-1999 Rubber, vulcanized or thermoplastic - Determination of tear strength (Trouser, angle and crescent specimens) (eqv ISO 34-1:1994)

GB/T 531-1999 Rubber - Determination of indentation hardness by means of pocket hardness meters (idt ISO 7619-1986)

GB/T 1681-1991 Rubber - Determination of rebound resilience of vulcanizates (eqv ISO 4662-1986)

GB/T 1682-1994 Rubber, vulcanized - Determination of low-temperature brittleness (single specimen method)

GB/T 1689-1998 Rubber vulcanized - Determination of abrasion resistance (Akron machine)

GB/T 1690-2006 Rubber vulcanized or thermoplastic - Determination of the effect of liquids (ISO 1817:2005, MOD)

GB/T 1692-1992 Vulcanized rubber - Determination of the insulation resistivity

GB/T 1695-2005 Rubber, vulcanized - Determination of electrical breakdown strength and voltage resistant at commercial power frequency

GB/T 3512-2001 Rubber, vulcanized or thermoplastic - Accelerated ageing and heat resistance tests - Air-oven method (eqv ISO 188:1998)

GB/T 3672.1-2002 Rubber - Tolerances of products - Part 1: Dimensional tolerances (ISO 3302-1:1996, IDT)

GB/T 3672.2-2002 Rubber - Tolerances of products - Part 2: Geometrical tolerances (ISO 3302-2:1998, IDT)

GB/T 4336-2002 Standard test method for spark discharge atomic emission spectrometric analysis of carbon and low - Alloy steel (routine method)

GB/T 6038-2006 Rubber test mixes - Preparation, mixing and vulcanization - Equipment and procedures (ISO 2393-1994, MOD)

GB/T 7759-1996 Rubber, Vulcanized or thermoplastic - Determination of compression set at ambient elevated or low temperatures (eqv ISO 815:1991)

GB/T 7762-2003 Rubber, vulcanized or thermoplastic - Resistance to ozone cracking - Static strain test (ISO 1431-1:1989, MOD)

GB/T 9867-1988 Rubber - Determination of abrasion resistance using a rotating cylindrical drum device (neq ISO 4649-1985)

GB/T 10125-1997 Corrosion tests in artificial atmospheres - Salt spray tests (neq ISO 9227-1985)

GB/T 10707-1989 Rubber - Determination of flammability by oxygen index (neq 190 4589-1984)

GB/T 11211-1989 Rubber vulcanized - Determination of adhesion to metal; Tension method (eqv ISO 814-1986)

GB/T 13488-1992 Rubber - Determination of the burning behaviour of vertical specimens (neq IEC 707-1981)

GB/T 16585-1996 Rubber, vulcanized - Test method of resistance to artificial weathering (Fluorescent UV lamp)

GB/T 19242-2003 Rubber, vulcanized - Determination of creep in compression or shear (ISO 8013-1988, MOD)

HG/T 3090 General rules of visual quality for moulded and extruded rubber products

3 Classification

3.1 Elastic rubber parts for primary suspension;

3.2 Elastic rubber parts for secondary suspension;

3.3 Elastic rubber parts for motor suspension;

3.4 Elastic rubber parts for device support;

3.5 Elastic rubber parts for flexible connection;

3.6 Elastic rubber parts for buffer limiting;

3.7 Other elastic rubber parts.

4 Environmental requirements

Operating temperature rang of elastic rubber parts is -50°C ~ +70°C.

5 Basic performances and requirements

5.1 Appearance and dimensions of elastic rubber parts

5.1.1 Appearance quality and geometric dimensions of elastic rubber parts shall meet the requirements of product design and relevant technical documents approved based on specified procedures; other unspecified requirements shall be executed in accordance with GB/T 3672.1-2002, GB/T 3672.2-2002 and HG/T 3090.

5.1.2 Rubber layer of elastic rubber-pile parts shall not have inclusion phenomenon; allowable quantity and type of defects existed in rubber layer shall conform to the provisions of HG/T 3090.

5.1.3 Rubber and metal adhesive place of elastic rubber-metal composite parts shall be free of stripping and other defects. Exposed metal shall not be corroded.

5.2 Basic performances of elastic rubber parts

Basic performances of elastic rubber parts shall at least include basic performances specified in Table 1; inspection criteria in Table 2 and tolerances in Table 3 shall be

Metal material texture and the physical and mechanical performance, heat treatment performance and salt-spray corrosion resistance performance shall meet the requirements of relevant technical documents approved based on specified procedures.

5.6 Requirements for other materials

Other materials shall meet the requirements in relevant technical documents approved based on specified procedures.

6 Test methods

6.1 General rules

6.1.1 Test temperature

Test shall be carried out at a specified test temperature. Unless otherwise specified, ambient temperature of test is 23°C + 2°C.

6.1.2 Force, displacement, velocity and frequency

Test shall be carried out under specified parameter and test conditions, Unless otherwise specified, applicable tolerance of parameters are as follows:

a) Time: ±2 min;

b) Speed: Specified test speed ±10% ;

c) Frequency: Specified test frequency ±10% ;

d) Force: Specified test value ±1%;

e) Moment of force: Specified test value ±1%;

f) Displacement: Specified test value ±1%.

6.1.3 Sample preparation

Samples for performance test of rubber materials shall be prepared in accordance with GB/T 6038-2006. In case of any special requirements, the body-sampling of products are made in accordance with specified technical documents.

6.2 Performance test methods of rubber materials

Performance test methods of rubber materials are shown in Table 4 ~ Table 7.

6.3 Performance test methods of metal materials and other materials

6.3.1 Metal material analysis is carried out in accordance with GB/T 4336-2002.

requirements. When one item of mechanical performance is unqualified, draw double samples for re-inspection, the products are qualified if all items are qualified. If one item is still unqualified, this batch of products is determined unqualified.

8 Marking, packaging, storage and transportation

8.1 Marking

8.1.1 Legible permanent marks shall be indicated at remarkable positions of elastic rubber parts.

8.1.2 Marking shall at least include the following contents:

a) Product model (if any);

b) Product trademark;

c) Manufacturer name or code;

d) Manufacturing year and month.

8.2 Packaging

Elastic rubber parts shall be separately packed in accordance with classification and specifications. Packaging shall be solid and reliable to ensure that products will not deform due to extrusion; outer package shall be indicated with product name, quantity, specifications, protection, etc. Inner package shall be accompanied by product certificates.

8.3 Storage

8.3.1 Elastic rubber parts shall be stored in a dry, ventilated and dark place and at an ambient temperature of -15°C ~ +40°C; products shall be stacked neatly and kept clean; it is strictly forbidden to contact with acids, alkalis, oils, organic solvents, etc.; products shall be more than 1 m away from the heat source and shall not be in direct contact with ground.

8.3.2 Shelf life of elastic rubber parts shall not exceed two years. If shelf life is long, there shall be relevant inspection prior to use, and the mechanical performances shall conform to relevant provisions and requirements.

8.4 Transportation

In transportation, elastic rubber parts shall avoid direct sunlight, rain and snow; and shall be kept clean and not in contact with substances that affect rubber quality.

Annex A

(Normative)
Static Performance Test Method

A.1Test environment

A.1.1 Ambient temperature test shall be carried out indoor at a constant temperature of 23°C ± 2°C.

A.1.2 Special ambient temperature test shall be carried out in environmental chamber (e.g. high and low-temperature environmental chamber); temperature deviation inside environmental chamber shall be within ±2°C; environmental chamber shall have automatic temperature adjustment device with accuracy of ±2°C.

A.1.3 In case of absence of constant temperatures, test may be carried out at room temperature of 5°C ~ 35°C, but specimen shall be taken out to complete the test within 30 min after specified temperature environment adjustment.

A.2 Environmental adjustment

A.2.1 There shall be environmental adjustment before rubber specimen receives ambient temperature test; standard temperature for adjustment is 23°C ± 2°C; adjustment time for rubber specimen is generally not less than 24 h.

A.2.2 There shall be environmental adjustment before rubber specimen receives special ambient temperature test; test shall be carried out in environmental chamber at a specified temperature (e.g. high and low-temperature environmental chamber); adjustment time is generally not less than 12 h; internal temperature deviation of environmental chamber shall be within ±2°C.

A.2.3 During specimen adjustment, whole surface of specimen shall be exposed to adjustment environment to the greatest extent and specimen shall avoid the impact from a variety of outside forces and direct sunshine. For specimens that require extrusion loading, placement time after press-in of test fixtures is determined by entrusting party and tester through negotiation.

A.3 Time interval between test and vulcanization

A.3.1 For performance test of all rubber specimens, the shortest time interval between vulcanization and test is 24 h.

A.3.2 The longest time interval between product test and vulcanization shall not exceed 3 months.

A.3.3 Product performance comparative test shall be carried out within a similar time

interval.

A.4 General requirements for test

A.4.1 Loading directions and method, test load and deformation range, number of specimens and test temperature shall be determined by entrusting party; there shall be one selected loading direction. USE a rectangular coordinate system, of which the vertical axis represents acting load *P* and horizontal axis represents deformation *S,* to continuously record P-S relationship.

Note: When it is used in reverse or yaw test, load and deformation marked part are replaced by torque, torsion angle or yaw angle.

A.4.2 One period of adding or subtracting load is about 1 min ~ 2 min; both load and deformation may be controlled. Load control is better used for large load and small deviation; deformation control is better used for small load and large deviation.

A.4.3 Dwell time before formal loading is not less than 3 min. Under special circumstances, it is determined in accordance with specimen's recovery situation.

A.4.4 When the same specimen is used for test under various temperature conditions, the order shall be from room temperature to high temperature, and then from room temperature to low temperature.

A.5 Test equipment and devices

A.5.1 Test equipment shall have load and deformation measuring and recording functions. Test load *P* shall be within 20% ~ 100% measuring range of test equipment. Test equipment load accuracy shall be within ±1% of indicated value; allowable deviation of measuring deformation shall be within ±1% of the maximum deformation of specimen .

A.5.2 Test equipment shall have vertical, horizontal or torsional loading test channels required for test; loading test channels shall have load and deformation control measurement function; DETERMINE loading direction, number of channels, load or deformation control mode in accordance with load bearing state of product in test.

A.5.3 Corresponding tooling shall be configured in accordance with structure and shape of product, loading mode and service conditions. Tooling shall ensure measurement accuracy of static characteristics. Clamping mode for test of specimens or objects shall simulate actual installation state and service conditions of products to the greatest extent.

A.6 Test modes

Select one from following modes:

a) Loading mode: LOAD specimen from zero to the upper limit of test load, and

Annex B

(Normative)
Dynamic Performance Test Method

B.1 Test environment

B.1.1 Ambient temperature test shall be carried out indoor at constant temperature of 23°C ± 2°C.

B.1.2 Special ambient temperature test shall be carried out in environmental chamber (e.g. high and low-temperature environmental chamber); temperature deviation inside environmental chamber shall be within ±2°C; environmental chamber shall have automatic temperature adjustment device with accuracy of ±2°C.

B.1.3 In case of absence of constant temperatures, test may be carried out at room temperature of 5°C ~ 35°C, but specimen shall be taken out to complete the test within 30 min after specified temperature environment adjustment.

B.2 Environmental adjustment

B.2.1 There shall be environmental adjustment before rubber specimen receives ambient temperature test; standard temperature for adjustment is 23°C ± 2°C; adjustment time for rubber specimen is generally not less than 24 h.

B.2.2 There shall be environmental adjustment before rubber specimen receives special ambient temperature test; test shall be carried out in environmental chamber at a specified temperature (e.g. high and low-temperature environmental chamber); adjustment time is generally not less than 12 h; internal temperature deviation of environmental chamber shall be within ±2°C.

B.2.3 During specimen adjustment, whole surface of specimen shall be exposed to adjustment environment to the greatest extent and specimen shall avoid the impact from a variety of outside forces and direct sunshine. For specimens that require extrusion loading, placement time after press-in of test fixtures is determined by entrusting party and tester through negotiation.

B.3 Time interval between test and vulcanization

B.3.1 For performance test of all rubber specimens, the shortest time interval between vulcanization and test is 24 h.

B.3.2 The longest time interval between product test and vulcanization shall not exceed 3 months.

B.3.3 Product performance comparative test shall be carried out within a similar time

interval.

B.4 General requirements for test

B.4.1 Loading direction and method of dynamic load, test frequency, average load or average deformation, load amplitude or deformation amplitude and test temperature, etc. are determined by entrusting party based on actual service conditions of rubber specimens for vibration damping.

B.4.2 Test starting temperature of specimen shall be the temperature determined based on test.

B.4.3 When the same specimen is used for tests under various conditions, the following order is usually followed:

a) Temperature: Based on the order from room temperature to high temperature, and then from room temperature to low temperature.

b) Average load, average deformation, load amplitude and deformation amplitude: In order to avoid hysteresis phenomenon in test, order from small to large shall be adopted. If this order may not be followed, changes may be from large to small, but each internal is better 10 min.

c) Frequency: Based on the order from small to large.

Note: To avoid rise of specimen temperature, measurement in various conditions are better completed within 1 min.

B.5 Test equipment and devices

B.5.1 Test equipment shall have load, deformation and vibration frequency measurement and recording functions. Test load P shall be within 20% ~ 100% measuring range of test equipment; allowable error of average load and average deformation measurement is ±3% of indicated value; allowable error of load amplitude and deformation amplitude measurement is ±5% of indicated value; allowable error of frequency measurement is ±2% of indicated value. Elastic deformation, elastic vibration and gap of testing machine shall not adversely affect test results.

B.5.2 Installation mode of specimen in test tooling and size and forms of specimen load bearing and constraint portions shall conform to practical conditions. Test tooling shall not affect accurate measurement of dynamic performance.

B.6 Data recording and processing

B.6.1 Record load waveform and distortion waveform

ADD load of sine waveform and deformation of sine waveform specimens; RECORD load and deformation time domain waveform of load. Based on this waveform (see

Annex C

(Normative)
Adhesive Strength Test Method

C.1 Test environment

C.1.1 Test shall be carried out indoor at constant temperature of 23°C + 2°C.

C.1.2 In case of absence of constant temperatures, test may be carried out at room temperature of 5°C ~ 35°C, take out specimen to complete the test within 30 min after predetermined temperature environment adjustment.

C.1.3 Special ambient temperature test shall be carried out in environmental chamber (e.g. high and low-temperature environmental chamber); it shall be ensured that specimen and set environment are in equilibrium .Temperature deviation inside environmental chamber shall be within ±2°C; environmental chamber shall have automatic temperature adjustment device with accuracy of ±2°C.

C.2 Environmental adjustment

C.2.1 There shall be environmental adjustment before rubber specimen receives test; adjustment standard temperature is 23°C ± 2°C.

C.2.2 At standard temperature, adjustment time of rubber specimen is generally not less than 24 h. For specimens that require extrusion loading, placement time after press-in of test fixtures is determined by entrusting party and tester through negotiation.

C.2.3 During specimen adjustment, whole surface of specimen shall be exposed to adjustment environment to the greatest extent and specimen shall avoid the impact from a variety of outside forces and direct sunshine.

C.3 Time interval between test and vulcanization

C.3.1 For performance test of all rubber specimens, shortest time interval between vulcanization and test is 24 h.

C.3.2 Longest time interval between product test and vulcanization shall not exceed 3 months.

C.3.3 Product performance comparative test shall be carried out within a similar time interval.

C.4 Test principle

Annex D

(Normative)
Compressive Creep Performance Test

D.1 General conditions of test

D.1.1 Test environment

D.1.1.1 Test shall be carried out indoor at constant temperature of 23°C ± 2°C.

D.1.1.2 Special ambient temperature test shall be carried out in environmental chamber (e.g. high and low-temperature environmental chamber); it shall be ensured that specimen and set environment are in equilibrium. Temperature deviation inside environmental chamber shall be within ±2°C; environmental chamber shall have automatic temperature adjustment device with accuracy of ±2°C.

D.1.2 Environmental adjustment

D.1.2.1 There shall be environmental adjustment before test for rubber specimen; adjustment standard temperature is 23°C + 2°C.

D.1.2.2 At standard temperature, adjustment time of rubber specimen is generally not less than 24 h. For specimens that require extrusion loading, placement time after press-in of test fixtures is determined by entrusting party and tester through negotiation.

D.1.2.3 During specimen adjustment, whole surface of specimen shall be exposed to adjustment environment to the greatest extent and specimen shall avoid the impact from a variety of outside forces and direct sunshine.

D.1.3 Time interval between test and vulcanization

D.1.3.1 For performance test of all rubber specimens, the shortest time interval between vulcanization and test is 24 h.

D.1.3.2 The longest time interval between product test and vulcanization shall not exceed 3 months.

D.1.3.3 Product performance comparative test shall be carried out within a similar time interval.

D.2 Test methods

D.2.1 General requirements

D.2.1.1 Loading direction and method of load, average load or average deformation

and test temperature, etc. are determined by entrusting party based on actual service conditions of rubber pieces for vibration damping.

D.2.1.2 Test starting temperature of specimen shall be the temperature determined based on test.

D.2.1.3 Unless otherwise specified, for the minimum creep time of product, when creep value of product after the latest 24 h is lower than 10% of creep value previous 24 h, test may be ended.

D.2.1.4 When the same specimen is used for tests under various conditions, the following order is usually followed:

a) Temperature: Based on the order from room temperature to high temperature, and then from room temperature to low temperature.

b) Load and deformation: In order to avoid hysteresis phenomenon in test, order from small to large shall be adopted. If this order may not be followed, changes may be from large to small, but better there is sufficient time interval each time.

D.2.2 Test equipment and devices

D.2.2.1 Test equipment shall have load and deformation recording functions. Permanent load control shall be available; test load is kept constant for long term; maximum fluctuation allowable error of load is not greater than ±1%. Test load *P* shall be within 20% ~ 100% of test equipment measuring range; allowable error of load and deformation measurement is no greater than ±1% of indicated value. Deformation, vibration and gap of testing machine shall not adversely affect test results.

D.2.2.2 Installation mode of specimen in test tooling and size and forms of specimen load bearing and constraint portions shall conform to practical conditions. Test tooling shall not affect accurate measurement of dynamic performance.

D.2.2.3 Height of specimen is usually measured by height gauge or vernier caliper; creep value is usually measured by dial indicator or dial gauge or deformation sensor is used to automatically record.

D.2.3 Test process

D.2.3.1 There shall be environmental adjustment to specimen before creep test.

D.2.3.2 MEASURE the initial height H_1 of specimen in a free state before creep.

D.2.3.3 INSTALL specimen to an appropriate position on loading device. In order to ensure uniform specimen bearing, make resultant force applied on specimen pass the center line of loading device to the greatest extent.

D.2.3.4 LOAD static force from 0 to specified test load within 30 s; PREVENT load

a) Name and number of specimens, stating the historical circumstances if necessary;

b) Test equipment, method, temperature (°C) and date;

c) Creep load (kN);

d) Curve changes of creep value over time;

e) Compression creep value and compression set after creep test;

f) Test results and conclusions;

g) Testers;

h) Other matters.

Annex E

(Normative)
Fatigue performance Test Method

E.1 Test environment

E.1.1 Ambient temperature test shall be carried out indoor at a constant temperature of 23°C ± 2°C.

E.1.2 In case of absence of constant temperatures, test may be carried out at room temperature of 5°C ~ 35°C.

E.1.3 Special ambient temperature test shall be carried out in environmental chamber (e.g. high and low-temperature environmental chamber); it shall be ensured that specimen and set environment are in equilibrium. Temperature deviation inside environmental chamber shall be within ±2°C; environmental chamber shall have automatic temperature adjustment device with accuracy of ±2°C.

E.2 Environmental adjustment

E.2.1 There shall be environmental adjustment before rubber specimen receives ambient temperature test; standard temperature for adjustment is 23°C ± 2°C。

E.2.2 At standard temperature, adjustment time of rubber specimen is generally not less than 24 h. For specimens that require extrusion loading, placement time after press-in of test fixtures is determined by entrusting party and tester through negotiation.

E.2.3 During specimen adjustment, whole surface of specimen shall be exposed to adjustment environment to the greatest extent and specimen shall avoid the impact from a variety of outside forces and direct sunshine.

E.3 Time interval between test and vulcanization

E.3.1 For performance test of all rubber specimens, the shortest time interval between vulcanization and test is 24 h.

E.3.2 The longest time interval between product test and vulcanization shall not exceed 3 months.

E.3.3 Product performance comparative test shall be carried out within a similar time interval.

E.4 General requirements for test

E.4.1 Test temperature

When test temperature is not specified, test shall be carried out at room temperature of 5°C ~ 35°C.

Based on test needs, test temperature may be 50°C, 70°C, 100°C, 125°C or 150°C.

When rubber heats and makes specimen temperature rise significantly, specimen is better cooled, e.g. through air cooling.

Special ambient temperature test shall be carried out in environmental chamber (e.g. high and low-temperature environmental chamber); temperature deviation inside environmental chamber shall be within ±2°C; environmental chamber shall have automatic temperature adjustment device with accuracy of ±2°C.

E.4.2 Loading conditions

Load deformation direction, average deformation or average load, deformation amplitude, load amplitude, vibration frequency, vibration cycle index, etc. are determined by entrusting party in accordance with actual application of vibration damping piece.

E.5 Test equipment

E.5.1 Test equipment shall have load and deformation measuring and recording functions. Test load *P* shall be within 20% ~ 100% measuring range of test equipment. Allowable deviation of test equipment load, deformation and frequency shall be ±5% of set value.

E.5.2 Test equipment shall have vertical, horizontal or torsional loading test channels required for test; loading test channels shall have load and deformation control measurement function; determine loading direction, number of channels, load or deformation control mode in accordance with load bearing state of product in test.

E.5.3 Corresponding tooling shall be configured in accordance with structure and shape of product, loading mode and service conditions. Clamping mode for test of specimens or objects shall simulate actual installation state of products and service conditions to the greatest extent.

E.6 Test methods

E.6.1 Constant-deformation fatigue test

FASTEN one end of specimen and apply alternating deformation with certain amplitude on the other end to evaluate its durability.

Generally adopt vibration waveform of sine waveform for test. CONTROL and record data on average load or average deformation, deformation amplitude, vibration

frequency or alternating cycle index time during test process.

E.6.2 Constant-load fatigue test

FASTEN one end of specimen and apply alternating deformation with certain amplitude on the other end to evaluate its durability.

Generally adopt vibration waveform of sine waveform for test. CONTROL and record data on average load or average deformation, deformation amplitude, vibration frequency or alternating cycle index time during test process.

E.7 Test procedures and characteristic measurement

E.7.1 At test temperature, use digital or pointer-type vernier caliper that division value is less than or equal to 0.02 mm to measure free height H_0 of specimen before loading.

E.7.2 TAKE five points at different positions of specimen surface to measure hardness through durometer; TAKE the average value as hardness test results H_{Af}. Hardness test method follows the provisions of GB/T 531-1999.

E.7.3 Static stiffness test is carried out on fatigue test equipment or other test equipment. According to the requirements proposed by customer, carry out static stiffness inspection in one, two or three directions. Inspection method follows the provisions in annex A.

E.7.4 APPLY fatigue load or deformation amplitude, frequency or fatigue times in accordance with predetermined requirements. During test process, when specimen temperature rise is required to measure, appropriate measures shall be taken to ensure accuracy of temperature measurement. When surface temperature of product exceeds 40°C, air cooling treatment is required or test frequency shall be reduced.

E.7.5 During dwell time of tests under different loading conditions, check whether specimen surface has cracks or bubbles and meanwhile check whether adhesive of rubber and metal degums. In case of any degumming, record the number and size; continue testing if degumming is not serious and strengthen monitoring (increasing the number of inspections); test shall be suspended if there is the possibility of complete breaking or disengaging.

E.7.6 After completing prescribed test cycles or beyond requirements for prescribed destruction, stop test immediately and unload tooling and fixtures. After specimen is kept for 24 h at standard temperature, measure free height H_t after fatigue test; rubber surface hardness H_{Aa} of specimen and static stiffness K_t.

E.8 Characteristic calculation

CALCULATE based on following formulas in accordance with test data inspected and measured before and after test.

Bibliography

[1] EN 13913-2003 Elastic Basic Components of Rubber Suspension Parts for Railways

[2] JIS E 4710-1995 General Rules on Rubber Vibration Isolators for Railway Rolling Stock

[3] JIS K 6385-2001 Test Method for Rubber Vibration Isolator

_____ END _____