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Fastening systems for high-speed railway Part 1: General requirement

高速铁路扣件 第 1 部分：通用技术条件

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Fastening systems for high-speed railway Part 1: General requirement

1 Scope

This Part specifies the technical requirements for high-speed railway fasteners AND main performance requirements of parts and components.

This Part applies to fasteners of high-speed railway's ballasted track and non-ballasted track.

2 Normative references

The following documents are essential to the application of this document. For the dated documents, only the versions with the dates indicated are applicable to this document; for the undated documents, only the latest version (including all the amendments) is applicable to this standard.

GB/T 6461 Methods for corrosion testing of metallic and other inorganic coatings on metallic substrates - Rating of test specimens and manufactured articles subjected to corrosion tests

GB/T 9258.1 Coated abrasives - Grain size analysis - Part 1: Grain size distribution test

GB/T 10125 Corrosion tests in artificial atmospheres - Salt spray tests

TB/T 3276 Rails for high speed railway

TB/T 3396.1 Test methods for fastening systems of high-speed railway - Part 1: Determination of longitudinal rail restraint

TB/T 3396.2 Test methods for fastening systems of high-speed railway - Part 2: Determination for clamping force

TB/T 3396.4 Test methods for fastening systems of high-speed railway - Part 4: Test of fatigue performance of fastening assembly

TB/T 3396.5 Test methods for fastening systems of high-speed railway - Part 5: Determination of electrical resistance

TB/T 3396.6 Test methods for fastening systems of high-speed railway - Part 6:

3.10.2 Fasteners are to be subjected to fatigue tests according to TB/T 3396.4, under the state of maximum rail height adjustment, during the design. After 3×10^6 load cycles, each component shall not be damaged; the gauge expansion shall not be greater than 6 mm.

3.11 Insulation properties

When tested according to TB/T 3396.5, the insulation resistance of fasteners shall not be less than 5 kΩ.

3.12 Influence of harsh environmental conditions

After 300 h salt spray test according to TB/T 3396.6, the fasteners can be disassembled and installed smoothly with manual removal tools.

3.13 Pullout resistance of embedded parts

The pull-out resistance of embedded parts, in concrete sleepers or track slabs, shall meet the design requirements AND shall not be less than 60 kN. After the pull-out test according to TB/T 3396.7, the embedded parts shall not be damaged; there shall be no visible cracks in the concrete around the embedded parts; however, a small amount of mortar peeling is allowed near the embedded parts.

3.14 Performance of grease for embedded casing

The performance of the grease, which is used for the embedded casing, shall meet the design requirements of the fastener.

4 Main performance requirements of components

4.1 General requirements

4.1.1 Parts shall meet the requirements of use AND have sufficient strength. During normal use, there shall be no abnormal cracks, expansion, etc.; non-metallic parts shall be resistant to oil and water erosion.

4.1.2 The type and size of parts shall meet the design requirements; the performance of raw materials and finished products shall meet the requirements of product technical conditions.

4.2 fasteners

The fasteners shall not break after being subjected to 5×10^6 fatigue tests, at the amplitude specified in Table 4.

Appendix A

(Normative)

Test method for static stiffness of elastic cushion

A.1 Symbols and definitions

F_1 - The minimum load applied to the elastic cushion under test, in kilonewtons (kN);

F_2 - The maximum load applied to the elastic cushion under test, in kilonewtons (kN);

D_1 - The displacement of the tested elastic cushion when it is loaded to F_1, in millimeter (mm);

D_2 - The displacement of the tested elastic cushion when it is loaded to F_2, in millimeter (mm);

K_{STA} - Static stiffness of elastic cushion, in kilonewtons per millimeter (kN/mm).

A.2 Principle

The vertical load is applied to the elastic cushion by the testing machine, to measure the maximum and minimum vertical displacement of the elastic cushion, under the maximum and minimum loads.

A.3 Equipment

A.3.1 Testing machine

A testing machine, that can apply a load of at least 100 kN and has an accuracy level of level 1.

During the low-temperature static stiffness test, the testing machine shall be able to reduce the ambient temperature of the elastic cushion under test to -35 °C, which has an indication error of 2 °C.

A.3.2 Loading steel plate

A flat steel plate, whose length is greater than the length of the tested elastic cushion along the rail direction, whose width is the same as that of the rail bottom used for the elastic cushion, whose thickness is 40 mm.

A.3.3 Load distribution plate

A flat steel plate, which has the same length, width, thickness as the iron backing plate,

used for testing the elastic cushion under the iron backing plate.

A.3.4 Support steel plate

A flat steel plate, whose length and width are not less than the length and width of the lower support of the elastic cushion under test, whose thickness is not less than 25 mm. When the length or width of the working platform of the testing machine is less than the length or width of the supporting steel plate, the thickness of the supporting steel plate shall not be less than 40 mm.

A.3.5 Abrasive cloth

Abrasive cloth, which complies with GB/T 9258.1 AND has a particle size of P 120.

A.3.6 Displacement sensor

Displacement sensor, which has an indication error of 0.01 mm, at 23 °C and -35 °C.

A.3.7 Recording equipment

Recording equipment, which is capable of digitally recording and drawing the load-displacement curve during the test, with a sampling frequency not lower than 100 Hz.

A.4 Test procedure

A.4.1 Static stiffness test at room temperature (23 °C)

The ambient temperature of the laboratory is 23 °C ± 3 °C.

Before starting the test, place the elastic cushion under test and all components and equipment, which are used for the test, in an environment of 23 °C ± 3 °C, for at least 24 hours.

Install on the testing machine in sequence: Supporting steel plate, abrasive cloth (the side with sand grains facing upward), the elastic cushion under test, the abrasive cloth (the surface with sand grains facing downward), load distribution plate (used when testing the elastic cushion under the iron backing plate; the load distribution plate is placed according to the on-site use status, so that the load distribution plate is placed in the effective area of the elastic cushion), the loading steel plate. Arrange at least three independent displacement sensors on the supporting steel plate, to measure the vertical displacement of the loaded steel plate at equal intervals, as shown in Figure A.1.

When the displacement sensor of the testing machine itself is used to measure the displacement of the loaded steel plate, it shall eliminate the systematic error caused by the deformation of the testing machine itself during loading.

A.4.2 Static stiffness test at low temperature (-35 °C)

The ambient temperature of the laboratory is 23 °C ± 3 °C.

Before starting the test, place the elastic cushion under test and all components and equipment used for the test, in an environment of 23 °C ± 3 °C, for at least 24 hours.

Place the elastic cushion under test, all components used for the test and displacement sensors on the testing machine, according to A.4.1. Start the testing machine, to lower the ambient temperature of the elastic cushion under test, after the installation is completed. Start timekeeping when it drops to -35 °C. Start formal test after 16 hours.

The loading method and static stiffness calculation method of the formal test shall be carried out, according to A.4.1.

When the displacement sensor of the testing machine itself is used to measure the displacement of the loaded steel plate, it shall eliminate the systematic error, which is caused by the deformation of the testing machine itself during loading.

A.5 Test report

The test report shall at least include the following:

a) The name and model of the tested elastic cushion;

b) Source of test piece;

c) Name and address of the laboratory;

d) Test method;

e) Test date;

f) Test results;

g) Test personnel.

Appendix B

(Normative)

Test method for dynamic stiffness of elastic cushion

B.1 Symbols and definitions

F_{1a} - The actual minimum load applied to the tested elastic cushion in the a-th cycle, in kilonewtons (kN);

F_{2a} - The actual maximum load applied to the tested elastic cushion in the a-th cycle, in kilonewtons (kN);

D_{1a} - The displacement of the measured elastic cushion in the a-th cycle, when it is loaded to F_{1a}, in millimeter (mm);

D_{2a} - The displacement of the measured elastic cushion in the a-th cycle, when it is loaded to F_{2a}, in millimeter (mm);

F_1 - The average value of the actual minimum load, which is applied to the elastic cushion under test, for 10 cycles, in kilonewtons (kN);

F_2 - The average value of the actual maximum load, which is applied to the elastic cushion under test, for 10 cycles, in kilonewtons (kN);

D_1 - The average displacement of the tested elastic cushion in 10 cycles, when it is loaded to F_{1a}, in millimeters (mm);

D_2 - The average displacement of the tested elastic cushion in 10 cycles, when it is loaded to F_{2a}, in millimeter (mm);

K_{DYN} - Dynamic stiffness of elastic cushion, in kilonewtons per millimeter (kN/mm).

B.2 Principle

The vertical cyclic load is applied to the elastic cushion by the testing machine, at a constant frequency, to measure the maximum and minimum vertical displacements of the elastic cushion, under the maximum and minimum loads.

B.3 Equipment

B.3.1 Testing machine

A testing machine, which is capable of applying a load of at least 80 kN, at a frequency of 3 Hz ~ 5 Hz, a static load of at least 100 kN, an accuracy level of level 1.

Appendix C

(Normative)

Fatigue test method for elastic cushions

C.1 Symbols and definitions

H_0 - The thickness of the measured elastic cushion before fatigue, in millimeters (mm);

H_1 - The thickness of the tested elastic cushion after fatigue, in millimeters (mm);

k_{s0} - The static stiffness of the tested elastic cushion before fatigue, in kilonewtons per millimeter (kN/mm);

k_{s1} - The static stiffness of the tested elastic cushion after fatigue, in kilonewtons per millimeter (kN/mm);

δ - Fatigue permanent deformation of the elastic cushion, expressed as a percentage (%);

ε - Change rate of static stiffness of elastic cushion, expressed in percentage (%).

C.2 Principle

The vertical cyclic load is applied to the elastic cushion, at a constant frequency, by the testing machine. After 3×10^6 load cycles, measure the permanent deformation and static stiffness change rate of the elastic cushion.

C.3 Equipment

C.3.1 Testing machine

A testing machine, which is capable of applying a load of at least 100 kN, at a frequency of 4 Hz ± l Hz and an amplitude of not less than 3 mm.

C.3.2 Short rail

The 60 kg/m rail, whose length is greater than the length of the measured elastic cushion along the rail direction.

C.3.3 Iron backing plate

When testing the elastic cushion under the iron backing plate, use the iron backing plate for the fasteners matching the elastic cushion under test.

C.3.4 Concrete foundation

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