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GB/T 17587.3-2017

Replacing GB/T 17587.3-1998

Ball screws –

Part 3: Acceptance conditions and acceptance tests

滚珠丝杠副 - 第 3 部分：验收条件和验收检验

(ISO 3408-3:2006, MOD)

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Foreword

GB/T 17587 “Ball screw” is divided into the following five parts:

- Part 1: Vocabulary and designation;
- Part 2: Nominal diameters and nominal leads - Metric series;
- Part 3: Acceptance conditions and acceptance tests;
- Part 4: Static axial rigidity;
- Part 5: Static and dynamic load ratings and operational life.

This part is part 3 of GB/T 17587.

This part was drafted in accordance with the rules given in GB/T 1.1-2009.

This part replaces GB/T 17587.3-1998 “Ball screws - Part 3: Acceptance conditions and acceptance tests”. As compared with GB/T 17587.3-1998, the main technical changes are as follows:

- In the “4.1 classification”, CHANGE the 7 standard tolerance grades into 8 standard tolerance grades, ADD the standard tolerance grade 0 in Table 1. Thereafter any part related to the standard tolerance grade and test item permissible deviation will be added with the standard tolerance grade 0 and the corresponding permissible deviation;
- In “4.2.1 Tolerance”, ADD the calculation formula of the travel variation tolerance v_{up} within the useful travel of the grade 0 accuracy;
- CHANGE the “4.2.2 Travel deviation” of 1998 version into “5.1 Overview”; ADD a new table in clause 5.1; CHANGE the Table 2 of the 1998 version into Table 3;
- CHANGE the “4.2.3 Calculation of measurement drawings” of the 1998 version into “4.2.2 Assessment of measurement drawings”; ADD “4.2.2.1 Overview”; CHANGE the original 4.2.3.1 and 4.2.3.2 into 4.2.2.2 and 4.2.2.3;
- MODIFY the Figure 2 in clause 5.1: CHANGE the “permissible deviation =” into “permissible deviation ≤”. ADD the figures and guide line 4 indicating the travel measuring device which is lacked in the original Figure;
- MODIFY the clause 5.1, 5.2 and 5.3, respectively, of the 1998 version into 5.2, 5.3 and 5.4; DELETE the Table 3, Table 4 and Table 5 in the 1998 version which are shared by many items into one table for each test item;

- CHANGE the “Mean travel deviation e” in the test item E1.1 and E1.2 of the 1998 version into the “Mean travel deviation e_{sa} and e_{0a}” AND the “Mean travel deviation e_{0a}” in the test item E1.2;

- MODIFY the test formula of the permissible deviation in the test item E1.2;

- In the inspection descriptions of the test item E4, ADD that “the letter n in the diagram represents the number of rotations of the ball screw as corresponding to the ball nut”;

- CHANGE the test item E6, E7, and E8 of the 1998 version, respectively, into E6.1, E7.1 and E8.1; ADD the test item E6.2, E7.2, and E8.2; in the diagram of E8.1, ADD the indicator and the formula to assess the inspection results;

- DIVIDE the permissible deviation column of the test item E12 into two conditions: $l_u \leq 4000$ mm and $l_u > 4000$ mm; ADD the permissible deviation $l_u > 4000$ mm; DELETE the notes on $l_u > 3000$ mm in the permissible deviation column of the 1998 version; CHANGE the “Ball screw (both ends without seals)” in the inspection descriptions of the 1998 version into “Ball screw (both ends with/without seals)”;

- MODIFY the title and the “Tolerance on specified travel” in the Table A.1 of Appendix A into “The tolerance value within the specified travel”;

- MODIFY the Table A.3 in Appendix A; DELETE the note below the original table.

This part, through the redrafting methods, modifies and adopts ISO 3408-3:2006 “Ball Screws - Part 3: Acceptance conditions and acceptance test”.

As compared with ISO 3408-3:2006, the main technical differences and the reasons of this part are as follows:

- In ISO 3408-3:2006, the ball screw standard tolerance grade does not have grade 2 and grade 4. Considering that the grade 2 and grade 4 ball screw is widely used in China, so in the Table 1 of the “4.1 Classification” in this part, it retains the treatment method in GB/T 17587.1-1998, adds the standard tolerance grade 2 and grade 4, after which once the standard tolerance grade and test item permissible deviation, the grade 2 and grade 4 standard tolerance grade and the corresponding permissible deviation are added;

- In “4.2.1 Tolerance”, same as GB/T 17587.1-1998, ADD the calculation formula of the travel variation v_{up} within the grade 2 and grade 4 accuracy useful travel;

- MAKE the following changes of the Figure 2 in clause 5.1: CHANGE the "permissible deviation =" into "permissible deviation ≤"; ADD the figure indicating the travel measuring device; INDICATE its guide line 4 again;

- In the test descriptions of the test item E4, ADD that "the letter n in the diagram represents the number of rotations of the ball screw as corresponding to the ball nut";

- In the test item E5, same as GB/T 17587.1-1998, in note 1, ADD that "at this time l_1 is the ball screw shaft total length";

- In the test items E6.1, E7.1 and E8.1, same as in E6, E7 and E8 in GB/T 17587.1-1998, ADD the note to the table that "it is agreed to allow the ball screw shaft top to be measured at the center hole";

- In Appendix A, taking into account the ball screw of nominal lead 4, 6, 8, 12, 16 ... is widely used, same as the Table A.2 in GB/T 17587.1-1998, ADD the specifications of the nominal lead, CHANGE the "Lead" in the table into "Nominal lead", CHANGE "P_h" into "P_{h0}";

- In Table A.3 of Appendix A, taking into account that the specification of nominal lead is modified in Table A.2, the original Table A.3 is modified accordingly.

This part makes the following editorial changes of ISO 3408-3:2006:

- In the "4.2.1 Tolerance" and the note to Table A.1 in Appendix A, for the determination method of the tolerance on specified travel e_p in the useful travel, CHANGE it from the descriptions without differentiating the accuracy grade into the descriptions based on grade 0 accuracy and based on other accuracy grades;

- MOVE the note to the arrow below the e_{sa} and e_{0a} of Figure 3b) in clause 4.2.2.3 of ISO 3408-3:2006 to the center line between the l'_2 and l_2;

- MODIFY the symbol "$v_{2\pi p}$" in the test item E4 of 5.2 in ISO 3408-3:2006 to "$v_{2\pi}$".

This part was proposed by China Machinery Industry Federation.

This part shall be under the jurisdiction of the National Standardization Technical Committee on Metal Cutting Machine (SAC/TC 22).

The drafting organizations of this part: Jiangsu Rui'an Special Machinery Group Co., Ltd., Beijing Machine Tool Research Institute, China Machine Tool Quality Supervision and Inspection Center, Nanjing Technology and Equipment

Ball screws –

Part 3: Acceptance conditions and acceptance tests

1 Scope

This part of GB/T 17587 specifies the technical acceptance conditions for ball screws (SEE Figure 1), in particular, the respective permissible deviations for the acceptance tests.

Note: The actual structure need not necessarily be consistent with the structure shown in Figure 1.

The required test items shall be agreed upon by the manufacturer and user.

This part applies to machine tool ball screw, the other can also make reference to it.

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) are applicable to this standard.

GB/T 1800.1-2009 Geometrical product specifications (GPS) - Limits and fits - Part 1: Bases of tolerances deviations and fits (ISO 286-1:1988, MOD)

GB/T 17421.1-1998 Test code for machine tools - Part 1: Geometric accuracy of machines operating under no-load or finishing conditions (eqv ISO230-1:1996)

GB/T 17587.1-2017 Ball screws - Part 1: Vocabulary and designation (ISO 3408-1:2006, MOD)

3 Terms and definitions

The terms and definitions as defined in GB/T 17587.1-2017 apply to this document.

$$b=\frac{n\cdot\sum\gamma_i\cdot e_i-\sum\gamma_i\cdot\sum e_i}{n\cdot\sum\gamma_i^2-\sum\gamma_i\cdot\sum\gamma_i}$$

Where:

e_a - Actual mean travel deviation as relative to the specified travel or the nominal travel;

γ - The angle of rotation of the ball nut as relative to the ball screw shaft (specified travel or nominal travel, as appropriate);

γ_i - The angle of rotation of i-th measurement point (it can also be as relative to the specified travel or nominal travel, as appropriate, of the i-th measurement point);

e_i - Travel deviation of the specified travel or nominal travel corresponding to the i-th measurement point;

n - The number of measurement points.

4.2.2.3 Graphic method [SEE Figure 3a) and Figure 3b)]

The method of determining the actual mean travel deviation based on the actual travel deviation is as follows:

a) MAKE tangents (l_1, l_2, ...) passing through two or more upper peak points on the actual travel deviation curve; MAKE tangents (l_3, ...) passing through the lower peak point;

b) DETERMINE each maximum deviation values (e_1, e_2, e_3, ...) parallel to the ordinate, SELECT the minimum value from these values (e_2 in the Figure);

c) DRAW a straight line through the minimum deviation point parallel to the tangent of the corresponding peak point (l'_2 in the Figure is parallel to l_2).

The actual average travel deviation e_a is the centerline between the two parallel lines (l'_2 and l_2) aforementioned. The bandwidth within the useful travel, that is, the distance e_2 between the above two parallel lines along the direction parallel to the ordinate, is the actual travel variation v_{ua} within the useful travel.