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NATIONAL STANDARD OF THE PEOPLE'S REPUBLIC OF CHINA

GB/T 14118-1993

Harmonic drive reducers

谐波传动减速器

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1 Scope

GB/T 14118-1993 is the Chinese national standard on harmonic drive reducers, in the field of mechanical systems and components. The /T suffix marks it as a recommended standard: it is not compulsory by itself, but it becomes binding as soon as a contract, a tender or a customer specification calls it up - which in practice is how most foreign buyers meet it. It was issued on 21 January 1993 by the State Bureau of Technical Supervision, and has been in force since 1 August 1993. Classification: ICS 21.220, CCS J19. This page is published from the official record of the standard held by the Chinese standards administration: the identification, the dates, the classification and the issuing body are taken from there. The clause text, the tables and the numeric limits are in the document itself, which is delivered complete in English translation.

This standard specifies the classification principles, technical requirements, test methods and inspection rules of harmonic drive reducers. This standard is mainly applicable to products in industries such as electronics, aviation, aerospace, robotics, machine tools, textiles, medical treatment, metallurgy, mining, etc.

2 Normative references

GB 699 Quality carbon structural steels - Technical conditions

GB 976 Classification and technical conditions of gray cast iron

GB 1096 Ordinary flat key - Type size

GB 1099 Half-round key - Type size

GB 2423.10 Electric and electronic products - Basic environmental test regulations for electricians - Test Fc: The vibration (sine) method

GB 2828 Sampling procedures and tables for lot-by-lot inspection by attributes (Apply to inspection of successive lots or batches)

GB 2829 Sampling procedures and tables for periodic inspection by attributes (Apply to inspection of stability for productive process)

GB 6404 Determination of sound power level for noise emitted by gear units YB

3 Terms

3.1 Harmonic drive It is a transmission that uses a wave generator to generate a controllable elastic deformation wave from a flexible gear, to realize movement and power transmission. In the working state, when the input shaft changes from forward to reverse rotation, the lag of the output shaft on the angle of rotation.

3.13 Drive error Under working conditions, when the input shaft rotates in one direction, the difference between the actual rotation angle and theoretical rotation angle of the output shaft.

4 Symbols and codes

4.1 XB - Cup type flexible gear harmonic drive reducer;

4.2 XBZ - Cup type flexible gear harmonic drive reducer with support;

4.3 A - Transmission accuracy level 1;

4.4 B - Transmission accuracy level 2;

4.5 C - Transmission accuracy level 3;

4.6 D - Transmission accuracy level 4;

4.7 A/B - Transmission accuracy mixed level, A means lost motion level 1 and B means drive error level 2

4.8 Y - Lubricating oil;

4.9 ZH - Lubricating grease.

5 Product classification

5.1 Variety specifications This standard harmonic drive reducer has 12 models and 60 transmission ratio specifications. The same model includes several transmission ratios (see

Table 3).

5.2 Type This standard is a single-stage horizontal double-shaft extension type harmonic drive reducer, which is divided into two types: large and small. Large reducer: the flexible gear and output shaft are assembled (see Figure 1); small reducer: the flexible gear and output shaft are integrated (see Figure 2).

5.3 Model when the flexible bearing is not less than 5000 h, the service life is 10000 h. Test: The test of life device and debugging are the same as 6.2.1. The test method steps: a. Before loading operation, it shall check whether the lubrication of the reducer and the cooling of the loader are normal. b. Start the motor, to run continuously for 500 h at rated speed and rated load. c. During operation, check the temperature of the prototype every

0.5 h; the temperature rise shall not exceed 45 °C.

6.2.3 Overload performance Requirements: When overloaded by 50%, it can run normally for 30 minutes; when overloaded by 150%, it can run normally for 1 minute. Test: Overload performance test must be carried out on the basis of no-load running-in test and loaded running-in test. No-load running-in test: The test device is the same as in 6.2.1. The adjusted reducer is running-in at the rated speed in forward and reverse rotation without load for 2 hours. Check that there shall be no oil leakage at the joints, no loose couplings, it runs smoothly without abnormal noise. Loaded running-in test: Apply 50%, 75%, 100% of the rated load to the reducer after no-load running-in at the rated speed; make it rotate in both forward and reverse direction for 2 hours, respectively. The inspection items are the same as the no-load running-in test. Overload performance test: At the rated speed, the reducer after the loaded running-in is overload 50% for rotation in the forward and reverse directions for 30 minutes, respectively. Overload it by 150% and make it rotate in the forward and reverse directions for 1 min, respectively. Inspection: a. Slippage is not allowed when starting; it shall be able to operate normally after starting; b. When the reducer is in overloaded operation, no abnormal vibration, noise, or damage to parts are allowed. c. After the test, disassemble and clean the reducer; replace the lubricating oil (grease) and reassemble it. Check the starting torque, rigidity and transmission accuracy, which shall meet the requirements. the X-Y function recorder automatically draws the stiffness curve of the harmonic reducer during the continuous change of the positive and negative loading of the loading rod. The typical stiffness curve of harmonic drive is a nonlinear hysteresis curve.

6.2.6 Transmission accuracy

6.2.6.1 Lost motion Requirements: Level 1 if <= 1'; level 2 if <= 3'; level 3 if <= 6'; level 4 if <= 9'. Test: Use static or dynamic measurement method. Static measurement uses optical indexing head, collimating light tube, optical polyhedron, etc. During the measurement, the optical indexing head is installed on the input shaft of the reducer; the polyhedral prism is fixed on the output shaft; the collimating light tube is adjusted to be perpendicular to one surface of polyhedron. When the input shaft changes from forward rotation to reverse

rotation, the difference between the two extreme rotation angles divided by the drive ratio is the lost motion of the output shaft. The measurement sampling points are not less than 72 points. The dynamic measurement adopts the grating type transmission chain checker. The input shaft is connected to the high-frequency grating head, the output shaft is connected to the low-frequency grating head. On the grating digital microscope, the number of signals at the two extreme positions is read out, then converted to the angle value of the lost motion.

6.2.6.2 Drive error Requirements: Level 1 if <= 1'; level 2 if <= 3'; level 3 if <= 6'; level 4 if <= 9'. Test: Use static or dynamic measurement method. Static measurement adopts optical indexing head, collimating light tube, optical polyhedron, etc. When measuring, the optical indexing head is connected to the input shaft of the reducer, the polyhedral prism is fixed on the output shaft of the reducer, the collimating light tube is adjusted to be vertically aligned with a certain side of the polyhedron. The difference between the theoretical rotation angle and the actual rotation angle of the output shaft relative to the input shaft is the drive error. The measurement sampling points shall be no less than 72 points. The dynamic measurement generally uses the grating type transmission chain checker. The input shaft is connected to the high-frequency grating head; the output shaft is connected to the low-frequency grating head. The signal difference between its input and output is drawn into an error curve by the automatic recorder, take the maximum value.

6.2.7 Moment of inertia of wave generator Requirements: See Table 7 for the moment of inertia of the wave generator of each model.

7.7 Samples for routine inspection shall be randomly selected from the batches that have passed the delivery inspection after half of all the unit products planned to be produced this quarter have been completed.

7.8 If the routine inspection is qualified, the representative product produced in this cycle can be delivered or stored as a qualified product after passing the delivery inspection.

7.9 If the routine inspection is unqualified, the routine inspection is allowed to be repeated. If it is a product quality problem, the batch of this representative products will stop delivery. The products that have been inspected but not exit- factory will be stopped from exit-factory. Products that have been exit-factory shall in principle be returned back to the supplier, or resolved by both parties through negotiation.

7.10 Routine inspection is performed once every six months. It shall also be carried out when the current product structure, main process, main materials are changed, or production is resumed after stopping production for more than three months.

8.1 Marking

8.1.1 Each reducer must be inspected and qualified before it can be marked for exit-factory.

8.1.2 Each reducer shall have a nameplate mark. The nameplate mark shall indicate the