

ICS 21.200
CCS J 17



**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

GB/T 30819-2024

Harmonic drive gear reducers for robot

机器人用谐波齿轮减速器

Issued on: September 29, 2024

Implemented on: April 1, 2025

**Issued by: State Administration for Market Regulation;
Standardization Administration of the PRC**

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Foreword

This document was drafted in accordance with the provisions of GB/T 1.1-2020 "Directives for standardization - Part

1. Rules for the structure and drafting of standardizing documents". This document replaces GB/T 30819-2014 "Harmonic drive gear reducers for robot". Compared with GB/T 30819-2014, in addition to structural adjustments and editorial changes, the main technical changes are as follows:

a) ADD the terms and definitions of "stiffness hysteresis curve" (see 3.6), "hysteresis loss" (see 3.7), "no-load starting torque" (see 3.9), "rated speed" (see 3.13), "transmission efficiency" (see 3.15);

b) CHANGE the terms and definitions of "harmonic drive gear reducer" (see 3.1;

3.1 of the 2014 edition), "flexspline" (see 3.3;

3.3 of the 2014 edition), "rigid spline" (see 3.4;

3.4 of the 2014 edition), "flexible bearing" (see 3.5;

3.5 of the 2014 edition), "torsional stiffness" (see 3.8;

3.6 of the 2014 edition), "no-load starting torque" (see 3.9;

3.7 of the 2014 edition), "transmission error" (see 3.10;

3.11 of the 2014 edition), "backlash" (see 3.11;

3.10 of the 2014 edition), "length of flexspline" (see 3.12;

3.12 of the 2014 edition), "rated torque" (see 3.14;

3.13 of the 2014 edition), "design life" (see 3.16;

1 Scope

GB/T 30819-2024 is the Chinese standard for harmonic drive gear reducers used in robots, the strain wave gearboxes that sit in almost every industrial robot wrist and in most collaborative arms. They are the component that determines what a robot can actually do: the ratio, the zero backlash, the torsional stiffness and above all the hysteresis and transmission error of the harmonic drive set the positioning accuracy and repeatability of the whole machine, and China's drive to build its own robots has depended on being able to make them domestically. The standard sets the model designation, the basic parameters and the structural dimensions, so that units are interchangeable; then the requirements, covering the materials of the main parts, the accuracy grades, the transmission error and hysteresis loss, the torsional stiffness, the backlash, the rated and permissible torque, the efficiency, the starting torque, the noise, the temperature rise and the life; and then the test methods for each of those, the inspection rules and the marking, packaging, transport and storage. It takes effect on 1 April 2025.

This document specifies the product classification, models, basic parameters and structural dimensions, requirements, test methods, inspection rules, marking, packaging, transportation, storage of harmonic drive gear reducers for robots. This document is applicable to harmonic drive gear reducers for robots.

2 Normative references

The following documents contain provisions which, through reference in this text, constitute provisions 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 191 Packaging and Transportation Pictorial Marks

GB/T 699-2015 Quality carbon structure steels

GB/T 1348-2019 Spheroidal graphite iron castings

GB/T 2828.11 Sampling procedures for inspection by attributes - Part 11. Procedures for assessment of declared quality levels for small population

GB/T 3077-2015 Alloy structure steels GB/T 13306 Plates

GB/T 13384 General specifications for packing of mechanical and electrical product

GB/T 35089-2018 Precision gear transmission for robot - Test method

GB/T 36491-2018 Precision cycloidal pin planetary gear transmission for robot - General technical requirements

GB/T 40729-2021 Fatigue life test method for precision gear transmission

3 Terms and definitions

The terms and definitions defined in GB/T 36491, as well as the following terms and definitions, apply to this document.

3.1 Harmonic drive gear reducer A reduction gear transmission device in which the input end drives a wave generator, causing the flexspline to undergo elastic deformation and form a small tooth difference motion with the rigid spline.

Note. Abbreviated as "reducer".

3.2 Wave generator A component that causes the flexspline to generate periodic elastic deformation waves according to a certain deformation law.

3.3 Flexspline A thin-walled external gear capable of producing controllable elastic deformation.

Note. The flexspline structure includes cup-shaped and top-hat shaped forms.

3.4 Circular spline An internal gear that maintains its original shape during operation relative to the flexspline.

3.5 Flexible bearing A thin-walled rolling ball bearing whose inner and outer rings are fitted onto a cam and can deform accordingly to the shape of the cam profile curve.

3.6 Stiffness hysteresis curve With the input end fixed, the output end is gradually loaded to the rated torque and then unloaded, then gradually loaded in the reverse direction to the rated torque and then unloaded. Multiple sets of output torque and angle values are recorded to draw a complete closed torque-angle curve.

Note. As shown in Figure 1. The ratio of the output power to the input power of the reducer.

3.16 Design life The minimum service time or number of revolutions that the reducer can meet, under the conditions of an input speed of 2000 r/min and an output torque equal to the rated torque during design and manufacturing.

4.1 Model

4.1.1 Reducer model It is composed of type code, specification code, transmission ratio, structure code, lubrication method, accuracy grade, connection method, as shown in Figure 2. Example. CS-25-50-U-G-111-I A reducer, which has a cup-shaped standard flexspline, specification 25, transmission ratio 50, complete unit type, grease lubrication, accuracy grade 111, standard connection type.

4.1.2 Type code Composed of two parts. flexspline shape and length. According to the flexspline shape, it can be divided into two types. cup-shaped and top-hat shaped, represented by capital letters C and H, respectively. According to the length of the flexspline, it is divided into two categories. standard and short-barrel, represented by the capital letters S and D, respectively.

4.1.3 Specification code The specification code corresponds to the pitch circle diameter of the flexspline. Multiplying the specification code value by

2.54 gives the pitch circle diameter of the flexspline (mm). The corresponding relationship between the two is shown in Table A.1 of Appendix A.

4.1.4 Transmission ratio Generally, six specifications are used. 30, 50, 80, 100, 120, 160. Special designs can also be made according to customer needs.

4.1.5 Structure code It is divided into two categories. complete machine and components, represented by the capital letters U and P, respectively.

4.1.6 Lubrication method It is divided into two types. grease lubrication and oil lubrication, represented by the capital letters G and O, respectively.

4.1.7 Accuracy grade The accuracy grade of the reducer is composed of transmission error, hysteresis loss, backlash. It shall be classified according to Table 1 and represented by a