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Precision cycloidal pin planetary gear transmission for robot - General technical requirements

机器人用摆线针轮行星齿轮传动装置

通用技术条件

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Table of Contents

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1 Scope

This Standard specifies terms and definitions, common structural forms, technical requirements, test methods, inspection rules, marks, packaging, transport and storage for precision cycloidal pin planetary gear transmission for robot (hereinafter referred to as the transmission).

This Standard is mainly applicable to robotics field. It is also used in other industrial fields where the transmission is required to be in a small size, light weight, large speed ratio, large torque, high precision, high rigidity, and high reliability.

2 Normative references

The following referenced documents are indispensable for the application 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 storage marks*

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

GB/T 6404.1, *Acceptance code for gear units - Part1: Test code for airborne sound*

GB/T 13306, *Plates*

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

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1 allowable torque during acceleration or deceleration

in the normal start or stop process, the maximum load (including inertia) torque allowed at the output end

3.2 backdriving torque

increasing start torque

the torque required when there is no load at the input end, and slowly twist the output end to the input end

3.3 no-load running torque

the input torque when there is no load at the output end, driving the input end, under different stable speeds. It can also be converted to the output torque according to the transmission ratio; and draw the speed-torque curve

3.4 momentary maximum allowable torque

the allowable value of the instantaneous maximum torque that the output end bears when subjected to an unexpected shock

3.5 allowable bending moment

to ensure normal operation, the allowable value of bending moment on the output end

3.6 momentary maximum allowable moment

the allowable value of the instantaneous maximum bending moment that the output end bears when subjected to an unexpected shock

3.7 bending rigidity

the ratio of the bending moment on the output end to the elastic deflection angle of the output end axis

3.8 torsional rigidity

when the input end is fixed, the ratio of the torque on the output end to the elastic torsion angle of the output end

3.9 hysteresis curve

fix the input end; gradually load the output end to the rated torque and then unload; reverse and gradually load to the rated torque and then unload; record torque and rotation angle values of multiple output ends; draw the completed closed torque-angle curve

As shown in Figure 1.

a) The connectors and fasteners are not loose;

b) All seals and joints have no oil leakage or exudation;

c) The operation is smooth, without impact.

5.3 Allowable torque during acceleration or deceleration

It shall comply with Table B.3.

5.4 Backdriving torque

It shall not exceed the one specified in Table B.3.

5.5 No-load running torque

At the rated speed, it shall not exceed the one specified in Table B.3.

5.6 No-load test

There must be no loose connection, impact, abnormal noise.

5.7 Load performance test

There must be no loose connection, impact, abnormal noise.

5.8 Overload test

Run at the allowable torque during acceleration or deceleration for 10min. Run at the momentary maximum allowable torque for 3s. The transmission can still operate normally.

5.9 Shell maximum temperature

Load to the rated torque at the rated speed. The maximum temperature of the shell shall not be greater than 60°C after reaching thermal equilibrium.

5.10 Transmission efficiency

At the rated speed and the rated torque, it shall not be lower than 80%.

5.11 Noise

At the rated speed and the rated torque, it shall not be greater than the one specified in Table B.4.

5.12 Momentary maximum allowable torque

It shall comply with Table B.5.

6.9 Shell maximum temperature

Run at the rated speed and the rated torque. Record the shell temperature value every 10min. When the temperature difference within 30min is less than 1°C, record the maximum temperature of the shell.

6.10 Transmission efficiency

Run at different working speeds. After the speed stabilizes, load by steps to the rated torque. Measure the torque and speed of the input and output ends under at least 5 torque levels to obtain the torque-efficiency curve at different speeds.

6.11 Noise

At the rated speed and the rated torque, noise inspection is carried out according to GB/T 6404.1.

6.12 Momentary maximum allowable torque

Complete verification in the overload test.

6.13 Allowable bending moment

At the rated speed and the rated torque, apply the allowable bending moment specified in Table B.6 according to the loading method in Figure 5 to complete the verification.

6.14 Momentary maximum allowable moment

At the rated speed and the rated torque, apply the momentary maximum allowable moment specified in Table B.5 according to the loading method in Figure 5. Duration does not exceed 5s.

6.15 Bending rigidity

The output end loads according to the method in Figure 5. Apply load force W_1 and load force W_2 that are perpendicular to each other. Gradually increase the load forces W_1, W_2. Record the values of θ, W_1, W_2. According to formula (1), calculate the bending rigidity K_m.

8 Marks, packaging, transport and storage

8.1 Marks

The transmission shall have a product identification in an easily identifiable position, in accordance with GB/T 13306. The content for identification includes:

a) Product name and model;

b) Nominal transmission ratio;

c) Name and address of the manufacturer;

d) Date of manufacture or batch number;

e) Implementation standard number or contract number;

f) Exit-factory number.

8.2 Packaging

The shaft extension and exposed installation datum surface of the transmission before packaging shall be treated with anti-rust and anti-physical damage.

Transmission packaging and transportation shall meet the requirements of GB/T 191 and GB/T 13384 or customer requirements. The following information shall be attached when leaving the factory:

a) Product qualification certificate;

b) Product instruction manual;

c) Packing list;

d) Accessories and list of accessories;

e) Other documents required by the customer.

8.3 Transport and storage

Pay attention to waterproof, moisture-proof, anti-corrosion and anti-vibration during transportation and storage. The transmission shall be stored in a dry place. If the storage period exceeds 6 months, check the rust condition once. Re-do anti-corrosion treatment if necessary.

Annex A

(informative)

Product classification

A.1 Product classification

According to the common product types of the transmission, the following classifications are made.

A.1.1 According to input configuration type

It is divided into coaxial input series (series A) and bias input series (series B). Further, according to the fastening form:

- series A is divided into: output flange bolt fastening type (L) and output flange pin combined fastening type (X);
- series B is divided into: output flange bolted type (L) and output flange through hole bolted type (T).

A.1.2 According to accuracy level

It is divided into level I, level II and level III. See Table B.7 for details.

A.2 Model

The transmission model is composed of specification code, rated output torque code, input configuration series, transmission ratio, fastening form and accuracy level, as shown in Figure A.1.

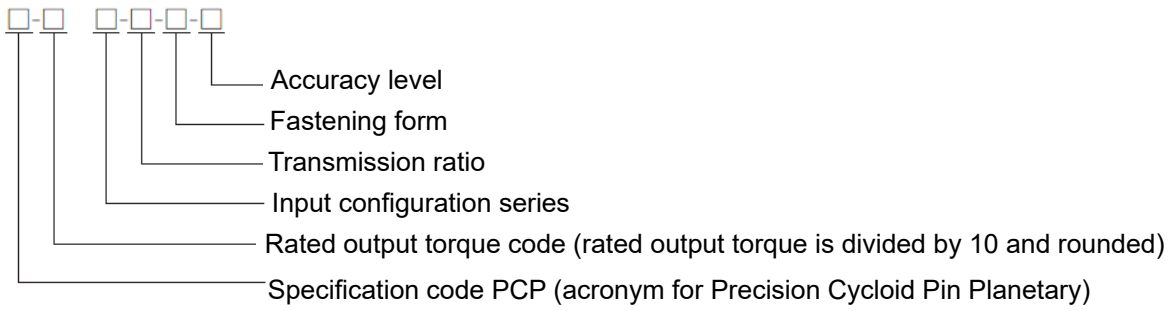

Figure A.1 -- The transmission model

Example: PCP-20A-121-L-I represents the precision cycloidal pin planetary gear transmission for coaxial input series robot, of which its rated output torque code is 20, the rated output torque is 177N·m, the transmission ratio is 121, the

fastening form is the output flange bolt fastening and the accuracy level is level I.

A.3 Transmission composition and output mode

As shown in Figure 2, it is mainly composed of input wheel, planetary gear, output flange, housing, PCP gear, crankshaft and other accessories.

The output methods mainly include the following three:

a) Fixed housing, input by input wheel, output by output flange;

b) Fixed output flange, input by input wheel, output by housing;

c) Fixed input wheel, input by housing, output by output flange.

A.4 Basic parameters

The structure of planetary-cycloidal pin series A is shown in Figure A.2. Nominal dimensions are shown in Table A.1 and Table A.2. Rated parameters are shown in Table B.1.

The structure of planetary-cycloidal pin series B is shown in Figure A.3. Nominal dimensions are shown in Table A.3 and Table A.4. Rated parameters are shown in Table B.2.

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