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GB/T 25627-2010

Construction machinery -- Power-shift transmissions

工程机械 动力换挡变速器

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Foreword

Annex A and Annex C of this Standard is informative, Annex B is normative.

This Standard is proposed by China Machinery Industry Federation.

This Standard is under the jurisdiction of National Technical Committee (SAC/TC 334) on Earthmoving Machine of Standardization Administration of China.

The responsible drafting organizations are Hangzhou Advance Gearbox Group Co., Ltd and Tianjin Research Institute of Construction Machinery.

The participation drafting organization is Sichuan Chengdu Chenggong Construction Machinery Co., Ltd.

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Construction machinery -- Power-shift transmissions

1 Scope

This Standard stipulates the symbols, units, requirements, test methods, inspection rules, marking, packaging, transportation and storage of the construction machinery -- power-shift transmissions.

This Standard is applicable to the construction machinery -- power-shift transmissions of 300kW or less (hereinafter referred to as transmissions). The transmissions above 300kW may refer to this Standard.

2 Normative References

The articles contained in the following documents have become this Standard when they are quoted herein. For the dated documents so quoted, all the modifications (excluding corrections) or revisions made thereafter shall not be applicable to this Standard. For the undated documents so quoted, the latest editions shall be applicable to this Standard.

GB/T 2828.1-2003 Sampling procedures for inspection by attributes - Part1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection (ISO 2859.1: 1999, IDT)

GB/T 3785 Electric, sonic properties and measuring methods for sound level meters

GB/T 7680 Torque converters -- Methods of performance tests

GB/T 13306 Plates

GB/T 14039 Hydraulic fluid power -- Fluids -- Method for coding the level of contamination by solid particles

GB/T 20082 Hydraulic fluid power-Fluid contamination-Determination of particulate contamination by the counting method using an optical microscope

JB/T 5947 Engineering machinery-- Specifications for packaging

3 Symbols and units

See Table 1 for the testing parameters of the transmissions and the names, symbols and units of the calculation parameters.

between failures (MTBF) of the transmissions shall not be less than 150h and the availability (K) shall not be less than 85%.

5 Test methods

5.1 Test equipment

5.1.1 This Standard recommends to use open-testbed. The benches are comprised of the power machines, loading equipment, fastening and connecting devices and auxiliary systems.

5.1.2 DC motors, DC dynamometers, AC speed control motors and diesel engines may be selected for the power machines.

5.1.3 DC dynamometers, DC generators, AC speed control motors, electric eddy current dynamometers, hydraulic loading system or hydraulic dynamometers may be selected for the loading equipment. Testbed layout is shown in Figure 1.

5.1.4 Auxiliary systems include oil supply system and water supply system. The oil supply system shall satisfy the maximum oil supply pressure and flow-volume at the operation of the transmissions and may be continuously adjusted. Heating and cooling devices shall be installed in the system. Water supply system shall meet the flow-volume requirements and provide adjustable and stable water-flow.

5.1.5 The no-load power loss tests of the transmissions and the transmissions efficiency tests of the transmissions shall use independent oil supply systems.

5.2 Test accuracy and instrument precision

5.2.1 Stabilization precision during the measurement process shall meet the following requirements:

—— Test system torque ripple is not greater than $\pm 0.5\%$;

—— The fluctuating value of rotating speed of the test systems shall not be more than $\pm 5\text{r/min}$.

flow-volume of the variable-speed pumps and keep the oil level of the oil pan at the prescribed height.

5.4.2.2 Test procedure for the transmissions with torque converter

Test procedure for the transmissions with hydraulic torque converter:

- a) The input rotating speed during the tests shall keep constant and comply with the stipulations in Table 4;
- b) At the beginning of the test, first, make the output shaft idle, increase the input rotating speed to the set value and record the data after the running is fully stable; then, gradually load the output shaft as per the set increment, decrease the output rotating speed and keep the output rotating speed constant;
- c) The interval of the loading torque shall be distributed arithmetically according to the torque of the output shaft and shall be properly reduced near the maximum efficiency and the working status transition points. The interval between the rotating speeds of the output shaft shall not more than one-tenth of the idle rotating speed of the output shaft;
- d) The minimum value of the output shaft rotating speed of the transmissions is selected at the lowest shift-gear at the zero-speed working condition of the torque converter. The input torque shall be subject to the maximum torque of the matched engine. For other shift-gears, select $n_2 \leq 0.3n_1/i_{F(R)}$.

5.4.2.3 Test procedures of separate transmissions

The following constant rotating speed test methods or constant torque test methods may be adopted.

5.4.2.3.1 Constant rotating speed test:

- a) Take two input rotating speeds for respective test. The high rotating speed $n_1=0.8n_{He}$ (for over-gear, select $n_1=0.6n_{He}$). The low rotating speed $n_1=0.4n_{He}$;
- b) At the beginning of the test, first, make the power machine idle, increase the input rotating speed to the set value and record the data after the running is fully stable; then, gradually load the output shaft and keep the output rotating speed constant;
- c) The interval for loading torque is arithmetically distributed in accordance with the input shaft torque;
- d) The maximum value of the input torque of the transmissions shall be determined

according to the input rotating speed, which is subject to the rated power transmitted by the transmissions.

5.4.2.3.2 Constant torque test:

- a) The input torque of the transmissions takes $2T_{He}$, $1.5T_{He}$, $1.0T_{He}$ and $0.5T_{He}$ respectively;
- b) Start the power machines and increase the input rotating speed to the rotating speed of the initial test; increase the load to the set value, record data after the running is fully stable, then gradually increase the input rotating speed and keep the input torque constant;
- c) The initial test rotating speed shall not be less than 600 r/min. The rotating speed interval shall be distributed arithmetically and shall not be more than 200 r/min;
- d) The maximum value of the input rotating speed of the transmissions shall be determined according to the input torque, which is subject to the rated power transmitted by the transmissions;
- e) Transmissions efficiency test shall record the following parameters: T_1 , T_2 , n_1 , n_2 , p_1 , p_2 , p_3 (or p'_3 , p''_3), p_4 , p_5 , t_1 , t_2 , Q . The recording of the parameters shall be synchronized;
- f) The same experiment is repeated three times;
- g) Draw relation curve $\eta=f(n_2)$ of the efficiency of each shift-gear of the transmissions with hydraulic torque converters and the output rotating speed as well as the relation curve $T_2=f(n_2)$ of the output torque and the output rotating speed; for a single transmission, draw relation curve $\eta=f(n_2)$ [constant torque] of the efficiency and the output rotating speed, the relation curve $\eta=f(T_2)$ [constant rotating speed] of the efficiency and the output torque, and the relation curve $T_2=f(n_2)$ of the output torque and the output rotating speed.

5.4.3 The shifting process test (test not required for single transmission)

5.4.3.1 Test conditions:

- a) The test is loaded with inertial load, the rotational inertia for transmissions output converted from the translational inertia of the main engine matched with the tested transmission is J ; the inherent rotational inertia for loading equipment of testbed is J_y , and

Note 2: The test of gear core hardness is positioned at the junction of tooth center line and root circle.

A.1.4 Middle carbon alloyed steel hardness and metallographic structure shall comply with:

- a) The quenching hardness of middle carbon alloy steel gear tooth surface is 50HRC-58HRC;
- b) The annular gear tooth surface hardness in planetary transmissions shall not be less than 40HRC, and the gear core hardness shall be 248HB-302HB when the hardness of effective case depth is larger than 0.25mm;
- c) The induction heating quenching part shall meet the provisions of 4.3.4 in JB/T 5944—1991.

A.1.5 When the gear has the precision of Grade 8, the gear tooth surface roughness R_a shall not be greater than 1.6 μm , and the annular gear tooth surface roughness R_a shall not be greater than 3.2 μm .

A.1.6 When the gear aperture is used as the bearing outer ring, the surface hardness shall not be less than 58HRC, the surface roughness R_a shall not be greater than 0.8 μm , and the cylindrical tolerance and roundness tolerance shall not be less than that of Grade 6.

Note: The form and position tolerance grade stipulated in this Standard shall be in accordance with the provisions of GB/T 1182 and GB/T 1184.

A.1.7 Run-out tolerance level for standard surface of gear shall not be less than 7.

A.2 Shaft parts

A.2.1 Recommend using steels of 20CrMnTi, 20CrMnMo, 20Cr, 40Cr, 40CrMnMo and 42CrMo as the materials. In case of any special requirement on materials, execute according to the provisions of "Technical Agreement for Supply of Materials". In the premise of ensuring performance index of transmissions shaft, allow selection of other materials.

A.2.2 The tolerance grade and coordination of involute spline shall meet the provisions of GB/T 3478.1-GB/T 3478.9, and the precision and coordination of rectangular spline shall meet the provisions of GB/T 1144.

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