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QC

INDUSTRY STANDARD

OF THE PEOPLE'S REPUBLIC OF CHINA

QC/T 27-2004

Replacing QC/T 27-1992

Bench test method of automobile clutch

(The Stand Test Method of Vehicle Dry Friction Clutch Assembly)

汽车干摩擦式离合器总成 台架试验方法

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Table of Contents

Preface

This standard is the revised version of QC/T 27-1992.

From the date of implementation, this standard shall replace QC/T 27-1992.

Compared with QC/T 27-1992, the main technical differences of this standard are as follows:

-- Adjust the requirements on the sliding friction torque and heat load of the clutch;

-- Add the requirements on the sliding friction coefficient and requirements on lid assembly static release durability.

This standard was proposed by Auto Industry Committee of China.

This standard shall be under the jurisdiction of Auto Standardization Technical Committee.

Drafting organizations of this standard: Changchun Auto Research Institute, Shanghai Clutch General Factory (now renamed as Shanghai Sachs Powertrain Components Systems Co., Ltd.), Nanjing Valeo Clutch Co., Ltd., Changchun Yidong Clutch Co., Ltd., and Sanhuan Group Huangshi Auto Clutch Co., Ltd.

The main drafters this standard: Yan Shidong, Chen Xiang, Yuan Nianshi, Song Shundong, and Yuan Hongquan.

Under assembly state, the pressure plate position corresponding to the nominal thickness of the driven plate assembly.

3.3 Clamp load at nominal disc thickness

Under assembly state, the clamp force applied by the pressure plate on the position at nominal disc thickness. See Figure 1. F_o is the working clamp force; F_m is the average working clamp force; F_u is the unload working clamp force; in which

$$F_m = \frac{F_u + F_o}{2} \quad \cdots\cdots (1)$$

3.4 Position after wear

Under assembly state, the pressure-plate's position that corresponds to - when the driven plate assembly has the allowable after-wear thickness.

3.5 Clamp load after wear

Under assembly state, it refers to the clamp load of the driven plate assembly that is applied by the pressure plate when it is at the working position after wear. See Figure 1. F_{o1} is the working clamp force after wear; F_m is the average working clamp force after wear; F_u is the unload working clamp force after wear; in which

$$F_{m1} = \frac{F_{u1} + F_{o1}}{2} \quad \cdots\cdots (2)$$

3.6 Release load characteristic

Use a pad having the same thickness as the driven plate assembly's clamp nominal thickness (or allowable after-wear thickness) to replace the driven plate assembly. And let the clutch lid assembly to be in the sate of simulation assembly. Under a certain preload, release and connect the clutch. It refers to the relation - the load F_A applied on the release finger (rod) AND the pressure-plate displacement h CHANGE along the release finger (rod) end travel λ_A, shown in Figure 2. In which, h_a is the pressure plate lift; Δh_a is pressure plate parallelism.

c) Load characteristic of lid assembly;

d) Unbalanced amount of lid assembly.

4.1.2 Function characteristic test of the driven plate assembly

a) The cushion deflection characteristic, clamp thickness, parallelism of the driven plate assembly;

b) The torque characteristic of the driven plate assembly;

c) Drag release characteristic of the driven plate assembly;

d) Unbalanced amount test of the driven plate assembly;

e) Test of clutch friction characteristic;

f) Adhesion resistive test.

4.1.3 Durability and reliability test of the clutches

a) Static release durability test of the lid assembly;

b) Release durability test of the lid assembly;

c) High speed resistive test of the lid assembly;

d) The cushion deflection durability test of the driven plate assembly;

e) Torque durability test of the driven plate assembly;

f) Heat resistivity test of the driven plate assembly.

4.2 The evaluation of the test results

Compare the test results with QC/T 25-2004 or drawings or technical requirements negotiated by the suppliers and the customers, according to the features, purposes of the test, to determine whether the sample can meet the requirements.

4.3 Test reports

After test, test report shall be prepared. The basic contents are as follows:

a) Test description;

b) Test basis;

c) Test purpose;

d) Test objectives;

e) Test methods and conditions;

5.3.2 Test procedure

5.3.2.1 Fix the lid assembly on the test fixture. Make the pressure plate in a free status. See Figure 4.

5.3.2.2 Apply load onto the pressure-plate. For spiral spring clutch, apply the load to make the pressure-plate to exceed about 2.5mm over the work position; for diaphragm spring clutch, apply the load to make the pressure-plate to exceed the trough displacement about 1mm. Then reduce the load until totally unloaded. Record the values on pressure-plate that the load changes along the pressure-plate's displacement.

5.3.2.3 Use test pad or other methods to determine the characteristic position, so as to determine the corresponding load characteristic value.

5.3.2.4 Draw the load characteristic diagram as Figure 1.

5.4 Determination of lid assembly unbalanced amount

5.4.1 Test equipment

5.4.1.1 Single-side balancer.

5.4.1.2 Balancing fixture specially for lid assembly.

5.4.2 Test procedure

5.4.2.1 Fix lid assembly on the test fixture, so as to make the lid assembly having the same positioning as actual positioning.

5.4.2.2 Measure the unbalanced amount of the lid assembly.

6 Function Characteristic Test of the Driven Plate Assembly

6.1 Cushion resilience, clamp thickness, parallelism of the driven plate

6.1.1 Test equipment

Ensure that the load is perpendicularly and evenly applied on the cushion resilience test bench of the driven plate assembly's friction surface AND the corresponding instruments apparatus. See Figure 5.

value at the time.

6.5.3.5 Cool down to room temperature.

6.5.3.6 Repeat the cycles for 1000 times as per 6.5.1. Draw the curves that torque changes along the time, at the cycle 100th, 200th,..., 1000th.

6.5.3.7 Weigh the mass of the driven plate assembly.

6.5.3.8 Repeat the cycles for 3000 times as per 6.5.1. Draw the curves that torque changes along the time, at the cycle 100th, 200th,..., 3000th.

6.5.3.9 Weigh the mass of the driven plate assembly.

6.5.3.10 Measure the working clamp force of the lid assembly.

6.5.4 Calculation

6.5.4.1 The friction coefficient for each test stage shall be calculated as follows:

$$\mu = \frac{M_d}{2 \cdot r_m \cdot F_A} \quad (3)$$

$$r_m = \frac{2(r_a^3 - r_i^3)}{3(r_a^2 - r_i^2)} \quad (4)$$

In the formula:

μ - Friction coefficient;

M_d – Torque;

r_m - Function radius of the friction disk;

r_a - Outer radius of the friction disk;

r_i - Internal radius of the friction disk;

F_A - Mean of the working clamp force of the lid assembly before and after test.

6.5.4.2 Determination of torque M_d

Record the mean value and minimum value of the cycle stages of 60th, 1000th, and 4000th.

6.5.4.3 Wear amount calculation

The mass difference before and after the test is the wear amount.

6.6 Anti-adhesion test

6.6.1 Test conditions

6.6.1.1 Use acetone or other cleaning agents to clean the surface of the pressure-plate and flywheel or

7.4 Cushion resilience durability test of driven plate assembly

This test can be done with 7.1 simultaneously.

7.4.1 Test conditions

a) Axial load: Repeat the to-and-fro cycle from 0 to specified load. The specified load shall be equal to the pressure load of the lid assembly that is matched with the tested driven plate assembly.

b) Release frequency: Not higher than 4Hz.

c) Test temperature: Room temperature.

7.4.2 Test equipment

See as 7.1.2.

7.4.3 Test procedure

7.4.3.1 According to 5.3, determine whether the working pressure load of the lid assembly complies with the requirements.

7.4.3.2 Measure the cushion resilience of the driven plate assembly in according to 6.1. And determine the cushion resilience before test.

7.4.3.3 Mount the tested driven plate assembly and lid assembly on the test bench.

7.4.3.4 Adjust the test bench, so as to meet the provisions of 7.4.1.

7.4.3.5 Releasing and then connecting clutch is considered one cycle.

7.4.3.6 Repeat the to-and-fro cycles to the specified cycle times.

7.4.3.7 Take the lid assembly from the tester. Visually inspect if there is any crack, looseness or damage.

7.4.3.8 Measure the cushion resilience characteristic of the driven plate assembly in according with 6.1. Determine the after-test cushion resilience amount.

7.5 Torque durability test of the driven plate assembly

7.5.1 Test conditions

a) Load style:

1) When load from one direction: 0 – 1.2 M_{emax}; or when load from two directions: positive direction 1.0 M_{emax}; negative direction 0.5 M_{emax} (M_{emax} is the largest torque of the motor).

2) Load based on the torque angle related to the above load.

b) Torque frequency: 6Hz-25Hz.

7.6.3.2 Take the driven plate assembly out from the constant temperature box. Immediately place it on the mandrel of the test bench. Accelerate the sample to the specified rotation speed.

7.6.3.3 Under the specified rotation speed, rotate continuously to the specified time or accelerate until it is exploded. Record the rotation speed when it is damaged.

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