# QC

AUTOMOBILE INDUSTRY STANDARD

OF THE PEOPLE'S REPUBLIC OF CHINA

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# QC/T 29096-2014

Replacing QC/T 29096-1992

# The bench test methods of automobile steering gear

汽车转向器总成台架试验方法

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## Appendix:

### Number, name, and date of implementation of 32 automotive industry standards

| No. | Standard number | Standard name | Number of standard replaced | Date of implementation |
|---|---|---|---|---|
| 1 | QC/T 231-2014 | Specification of kick-starter for motorcycles and mopeds | QC/T 231-1997 | October 01, 2014 |
| 2 | QC/T 233-2014 | Performance and measurement method for static intensity of motorcycles and mopeds | QC/T 233-1997 | October 01, 2014 |
| 3 | QC/T 66-2014 | Wet clutch for moped and motorcycles | QC/T 66-1993 | October 01, 2014 |
| 4 | QC/T 962-2014 | Technical specifications for coating of motorcycles and moped | | October 01, 2014 |
| 5 | QC/T 680-2014 | General technical specifications for voltage regulators for motorcycles and moped | QC/T 680-2002 | October 01, 2014 |
| 6 | QC/T 963-2014 | Drum brakes of motorcycles and mopeds wheels | | October 01, 2014 |
| 7 | QC/T 234-2014 | General technical specifications for steering shaft for motorcycles and moped | QC/T 234-1997 | October 01, 2014 |
| 8 | QC/T 964-2014 | The strength of plastic seats and their anchorages for city buses | | October 01, 2014 |
| 9 | QC/T 644-2014 | Technical specifications for automotive metallic fuel tank | QC/T 644-2000 QC/T 488-2000 | October 01, 2014 |
| 10 | QC/T 965-2014 | Driver of electric rear-view mirrors for motor vehicles | | October 01, 2014 |
| 11 | QC/T 966-2014 | Technical specifications for automotive plastic parts coatings | | October 01, 2014 |
| 12 | QC/T 459-2014 | Truck with loading crane | QC/T 459-2004 | October 01, 2014 |
| 13 | QC/T 29106-2014 | Technical specification of automobile wire harness | QC/T 29106-2004 | October 01, 2014 |
| 14 | QC/T 198-2014 | General technical specification for automotive switch | QC/T 198-1995 | October 01, 2014 |
| 15 | QC/T 220-2014 | Technical specifications for automotive fusible links | QC/T 220-1996 | October 01, 2014 |
| 16 | QC/T 967-2014 | Port fuel injector for gasoline engine | | October 01, 2014 |
| 17 | QC/T 968-2014 | Determination methods of platinum, palladium and rhodium contents in metallic catalytic converters | | October 01, 2014 |
| 18 | QC/T 969-2014 | Interior truck release for compartment of a passenger car | | October 01, 2014 |
| 19 | QC/T 636-2014 | Electric window regulator specification for vehicles | QC/T 636-2000 | October 01, 2014 |
| 20 | QC/T 970 2014 | Passenger car air filter technical specification | | October 01, 2014 |

# The bench test methods of automobile steering gear

## 1 Scope

This Standard specifies the bench test methods of recirculating-ball automobile steering gear and pinion-and-rack automobile steering gear.

This Standard applies to recirculating-ball and pinion-and-rack automobile steering gear.

## 2 Normative references

The following documents are indispensable for the application of this Standard. For the dated references, only the editions with the dates indicated are applicable to this Standard. For the undated references, the latest edition (including all the amendments) are applicable to this Standard.

GB/T 5179 Motor vehicle - Steering system - Terms and definitions

QC/T 29097 The technical specifications of automobile steering gear

## 3 Terms and definitions

The terms and definitions defined in GB/T 5179 and QC/T 29097 apply to this Standard.

## 4 General requirements

### 4.1 Test type

The test items of this Standard, from the main categories, are divided into the following three types:

- Performance test;

- Strength test;

- Durability test.

### 4.2 Accuracy of test instruments

The accuracy of the test instruments used in each test item must meet the following corresponding requirements:

- Accuracy requirement of angle sensor: 0.1°;
- Accuracy of displacement sensor: 0.01 mm;
- Accuracy of torque sensor: 1%;
- Accuracy of force sensor: 1%.

# 5 Test methods

## 5.1 Performance

**5.1.1** Full rotation angle of input shaft.

FIX the steering gear. There shall be no gap between the sensor and the input shaft. ROTATE the input shaft from one limit position to another limit position; MEASURE the total rotation angle.

**5.1.2** Rack travel.

FIX the steering gear. There shall be no gap between the sensor and the rack. Install pull rods or substitutes on both ends of the rack; MEASURE the distance that the rack moves from one end to the other.

**5.1.3** Transmission ratio.

**5.1.3.1** Angular transmission ratio of recirculating-ball steering gear.

FIX the steering gear. Install the angle sensor close to the input shaft and the rocker arm shaft; the connection is required to be gap-free, see Figure 1. ROTATE the input shaft from one-end limit position to the other-end limit position; DRIVE the input shaft at a speed of 10r/min ~ 15 r/min; MEASURE the instantaneous angle values of the input shaft and the rocker arm shaft.

and reverse torque of the input shaft in the whole process. The input shaft speed is 15r/min.

REMOVE about 30° at both ends of the relationship curve, obtained by the test, between the rotation angle and the torque. Calculate the average torque of ± 180° in the middle and the average torque of the remaining rotation angles on both sides.

**5.1.5** Rack moving force.

FIX the steering gear housing. Connect the force sensor and displacement sensor to the rack. The connection is required to be free of gaps. PUSH (PULL) the rack; MEASURE the moving force of the rack. The rack moving speed is 0.5m/min.

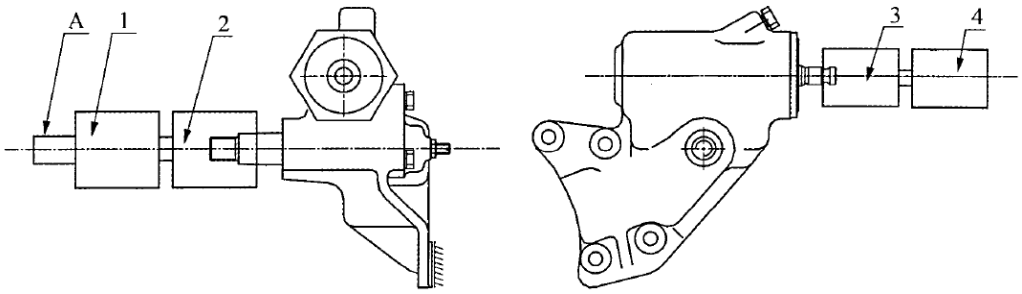
REMOVE the 3mm data at both ends of the displacement and force relationship curve obtained by the test; DRAW the displacement and force relationship curve.

**5.1.6** Transmission clearance.

**5.1.6.1** Transmission clearance of recirculating-ball steering gear.

Method 1: FIX the rocker arm shaft and the housing; LOAD a torque of ± 2N • m on the input shaft end; MEASURE the difference of the input shaft rotation angle, which is the clearance of this point (used for exit-factory test).

Method 2: Connect angle sensors to the input shaft and rocker arm shaft, respectively. The connection is required to be free of gaps. ADD a load of 10N • m to the rocker arm shaft; at a speed of 10r/min ~ 15r/min, drive the input shaft forward. MEASURE the instantaneous corresponding angle values of the input shaft and the rocker arm shaft. Then at the same speed, reversely drive the input shaft, to measure the same data (see Figure 3).




1 - Torque sensor; 2, 3 - Angle sensor; A - Fixed or add ± 10N • m torque

**Figure 3 -- Schematic diagram of test of recirculating-ball transmission clearance**

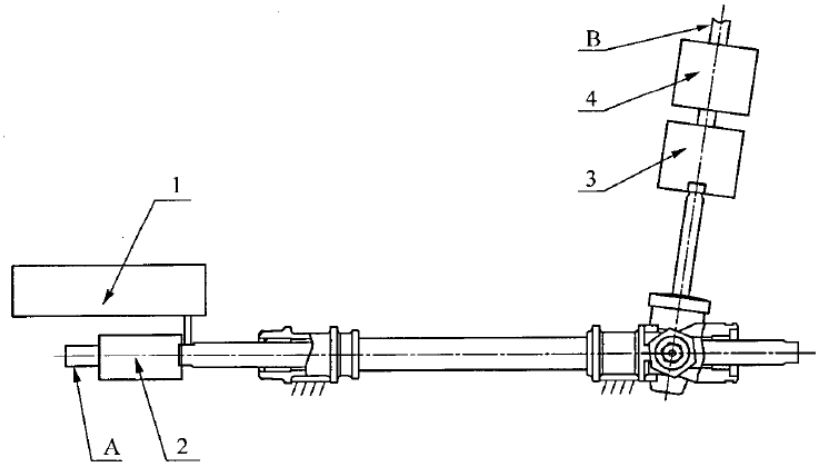
$M_1$, $M_2$ - Input and output torque of rocker arm shaft, N • m;

$W_1$, $W_2$ - Input and output torque of input shaft, N • m.

**5.1.7.2** Transmission efficiency of pinion-and-rack steering gear.

FIX the steering gear. Connect the torque sensor and angle sensor to the input shaft. Connect the force sensor and displacement sensor to the rack. The connection is required to be free of gaps. At a speed of 15r/min, drive the input shaft; MEASURE the torque and rotation angle, force and displacement. In reverse efficiency, according to the transmission ratio and the input shaft speed, the drive speed is converted into rack displacement speed. The test load is loaded according to the load efficiency curve required by the manufacturer. When not required, load according to the input shaft torque 4N • m ~ 5N • m, see Figure 6 (during the test, the steering gear has no pull rod and dust cover).

REMOVE about 30° at both ends of the input shaft rotation angle data obtained by the test and remove the corresponding torque and force. According to formula (5) and formula (6), calculate the efficiency of each point. DRAW the curve of input shaft rotation angle and efficiency. Calculate the average efficiency within the range of ± 180° in the middle and the average efficiency of the remaining rotation angles on both sides.




1 - Displacement sensor; 2 - Force sensor; 3 - Angle sensor; 4 - Torque sensor;

A - Drive or load along the reciprocating straight line direction; B - Drive or load along the clockwise and counterclockwise directions

**Figure 6 -- Schematic diagram of test of efficiency of pinion-and-rack steering gear**

The efficiency is calculated according to formula (5) and formula (6):

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