GB

NATIONAL STANDARD OF THE

PEOPLE'S REPUBLIC OF CHINA

ICS 43.020

CCS T 04

GB/T 12540-2024

Replacing GB/T 12540-2009

Minimum turning clearance circle diameter, turning clearance circle and swing-out value test method for motor vehicles and combination of vehicles

汽车及汽车列车最小转弯直径、转弯通道圆和外摆值测量方法

Issued on: December 31, 2024 **Implemented on: April 01, 2025**

Issued by: State Administration for Market Regulation;
Standardization Administration of the People's Republic of China.

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1 Scope

This document describes the test conditions and test methods for measuring the minimum turning clearance circle diameter, turning clearance circle and swing-out value of vehicles and vehicle trains.

This document applies to vehicles and vehicle trains.

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 3730.1, *Terms and definitions of motor vehicles, trailers and combination vehicle - Part 1: Type*

GB/T 12534, *Motor vehicles. General rules of road test method*

GB/T 15089, *Classification of power-driven vehicles and trailers*

3 Terms and definitions

For the purposes of this document, the terms and definitions defined in GB/T 3730.1 and GB/T 15089 as well as the followings apply.

3.1 minimum turning clearance circle diameter

When the steering wheel of a vehicle or a train is deflected to the extreme position, the outermost trajectory circle diameter of the center of contact of the steering wheel tread of each steering axle of the vehicle on the flat ground.

NOTE 1: For a vehicle train, the steering wheel is deflected to the maximum position where the wheels on the rear axle of the trailer do not rotate in the opposite direction and there is no motion interference with the train.

4 Test conditions

4.1 Test site and weather conditions

4.1.1 The test site is a flat, solid, dry asphalt or concrete surface. The slope in any direction is not more than 2%. Its size can ensure that the vehicle can make a circular motion with a diameter of not less than 30 m.

4.1.2 Meteorological conditions such as ambient temperature and wind speed shall comply with the requirements of GB/T 12534.

4.2 Vehicle conditions

4.2.1 The tyre model of the vehicle shall comply with the regulations of the vehicle manufacturer. The tyre pressure shall comply with the regulations of GB/T 12534.

4.2.2 The vehicle's wheel alignment parameters and the maximum steering angle of the steering wheel should comply with the regulations of the vehicle manufacturer.

4.2.3 The minimum turning clearance circle diameter test of the vehicle is carried out in the unloaded state. The turning clearance circle and the swing-out value test are carried out in the unloaded and fully loaded states respectively.

NOTE 1: Unloaded state: The state when the vehicle's curb weight is added to the weight of the driver and necessary track measurement equipment.

NOTE 2: Fully loaded state: The state when the vehicle is loaded to the maximum designed gross mass.

4.2.4 For vehicles equipped with lifting axles, when conducting the minimum turning clearance circle diameter and turning clearance circle tests in the unloaded state, the lifting axle should be in the state with the largest theoretical wheelbase in the grounded or lifted mode.

NOTE 1: The theoretical wheelbase refers to the distance between the first axle of the vehicle (or the center of the kingpin) and the center line of the grounded axle in the rear axle group.

NOTE 2: For a vehicle train, the tractor vehicle and the trailer are both in the state of maximum theoretical wheelbase.

4.2.5 For vehicles equipped with a lifting axle, when conducting the swing-out value test under unloaded state, the lifting axle should be in the state with the longest rear overhang in the grounded or lifted mode.

4.2.6 Before the test, the vehicle parameters should be checked and the inspection results should be filled in with reference to Table A.1 in Annex A.

as the final result of the vehicle's minimum turning clearance circle diameter.

5.1.8 Fill in the test records and results according to Table A.2.

5.2 Minimum turning clearance circle diameter of trains

5.2.1 Position the measuring point of the driving trajectory collection device at the contact center of all outer steering tyres of the vehicle train.

5.2.2 The train is travelling at a constant speed of no more than 10 km/h. The steering wheel angle is gradually increased during the travel until one of the following situations occurs:

a) Gradually increase the steering wheel angle until it reaches the limit position. If there is no motion interference between the vehicles and the inner tyres of the trailer do not rotate in the opposite direction, keep the steering wheel limit angle unchanged;

b) When gradually increasing the steering wheel angle, if the inner wheels of the trailer rotate in the opposite direction, slowly reduce the steering wheel angle so that the inner wheels of the trailer do not rotate, and keep the steering wheel angle unchanged;

c) When gradually increasing the steering wheel angle, if the vehicle is about to experience motion interference or the mechanical connection device reaches the maximum working angle, the current steering wheel angle remains unchanged.

NOTE: The inner wheels of the trailer do not rotate means that when the test vehicle maintains the steering wheel angle and travels one circle, the rotation angle of the rear inner wheels of the trailer is within the range of ±180°.

5.2.3 The vehicle train continues to travel until the trailer reaches a stable state. The trajectory collection device is started. The vehicle travels one circle (360°).

5.2.4 Record the closed motion trajectory of the contact point center of each outer steering tyre on the ground.

5.2.5 The diameter of the closed track circle formed by the center of contact with the ground of each steering tyre should be measured in at least two directions perpendicular to each other, and the arithmetic mean of the measured values in all measuring directions shall be taken as the diameter of the track circle of the center of contact with the ground of the steering tyre.

5.2.6 Take the maximum value of the center track circle diameters of each steering tyre as the measurement result of the minimum turning clearance circle diameter of the vehicle train.

5.2.7 The left turn and right turn directions should be measured once each. The

measurement results should be recorded.

5.2.8 Take the maximum value of the left-turn and right-turn measurement results as the final result of the minimum turning clearance circle diameter of the vehicle train.

5.2.9 Fill in the test records and results according to Table A.2.

5.3 Turning clearance circle

5.3.1 Turning clearance circle with specified diameter

5.3.1.1 Draw concentric circles with specified outer and inner diameters on the ground as turning paths for vehicles or trains.

5.3.1.2 The vehicle or vehicle train is stopped on the test site in a straight-line driving position.

5.3.1.3 The vehicle or vehicle train enters the turning clearance circle at a relatively low stable speed (the lowest stable speed or the speed is not more than 10 km/h). The motion trajectory of the vehicle's farthest point from the turning center projected on the ground coincides with the outer circle of the channel circle (or is located inside the outer circle). It drives continuously for at least one circle (360°).

5.3.1.4 Record whether the point on the vehicle or vehicle train closest to the turning center is beyond the inner circle of the turning clearance circle.

5.3.1.5 The left turn and right turn directions should be measured once each.

5.3.1.6 Fill in the test records and results according to Table A.3.

5.3.2 Minimum turning clearance circle

5.3.2.1 Position the measuring points of the driving track collection device at the farthest point and the closest point of the vehicle from the turning center. For a vehicle train, position the measuring points of the driving track collection device at the farthest point of the tractor from the turning center and the farthest point of the trailer from the turning center and the closest point to the turning center.

5.3.2.2 Vehicles shall be tested in accordance with 5.1.2. Vehicle trains shall be tested in accordance with 5.2.2 and 5.2.3. The closed motion trajectory of each measuring point specified in 5.3.2.1 on the ground shall be recorded.

5.3.2.3 Measure the diameter of the closed track circle formed on the ground by the farthest point and the closest point from the turning center. The measurement should be made in at least two directions perpendicular to each other. Take the arithmetic mean of the measured values in each direction as the outer and inner diameters of the minimum turning clearance circle. Calculate the corresponding turning channel width.

farthest point from the turning center at the front of the vehicle and the outermost point at the rear of the vehicle.

5.4.2.2 Park the vehicle on a flat surface. The steering wheels are in a straight-line driving state. Draw a projection line parallel to the longitudinal centerline of the vehicle from the outermost point of the vehicle side to the ground. Draw a circular contour line with a diameter of 25.00 m tangent to the ground on the vehicle side of the projection line.

NOTE: The outermost point on the side of the vehicle train is the outermost point on the side of the trailer.

5.4.2.3 Start the trajectory acquisition device. The vehicle starts to move forward along the projection line at a relatively low stable speed (the lowest stable speed or a speed not exceeding 10 km/h). Turn the steering wheel to make the point at the front of the vehicle farthest from the steering center transition from straight-line driving to the circular contour line described in 5.4.2.2. Make the motion trajectory of this point projected on the ground continue to move along the circular contour line. Drive at least until the trajectory of the outermost point of the rear of the vehicle intersects the projection line made in 5.4.2.2 again, and the vehicle stops (see Figures 5 and 6).

5.4.2.4 Measure the maximum vertical distance between the trajectory of the outermost point of the vehicle rear and the projection line, which shall be taken as the measurement result of this swing-out value test.

5.4.2.5 The left and right turns should be measured at least twice each. The difference between the maximum and minimum values of the measurement results in the same direction should not exceed 5% of the minimum value. The arithmetic mean of the valid measurement results in the same direction shall be taken as the measurement result in that direction.

5.4.2.6 Take the maximum value of the left-turn and right-turn direction measurement results as the final measurement result of the vehicle.

5.4.2.7 Fill in the test records and results according to Table A.4.

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