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Towing tractor

牵引车

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Towing tractor

1 Scope

This standard specifies the terms and definitions, basic parameters, technical requirements, test methods, inspection rules, signs, accompanying documents, transportation, storage of the following types of towing tractors:

- a) Battery towing tractor;
- b) Internal combustion towing tractors, including: towing tractors fueled by diesel, gasoline, liquefied petroleum gas, natural gas, as well as hybrid towing tractors.

This standard applies to battery towing tractors, which have a rated hook traction force not greater than 20 kN, AND internal combustion towing tractors, which have a rated hook traction force not greater than 32 kN. Battery towing tractors, which have a rated hook traction force greater than 20 kN AND internal combustion towing tractors, which have a rated hook traction force greater than 32 kN, may use this standard as a reference.

This standard is also applicable to liquefied petroleum gas towing tractors, liquefied natural gas towing tractors which have a rated pressure not greater than 1.6 MPa, compressed natural gas towing tractors which have a rated pressure not greater than 20 MPa.

2 Normative references

The following documents are essential to the application of this document. For the dated documents, only the versions with the dates indicated are applicable to this document; for the undated documents, only the latest version (including all the amendments) is applicable to this standard.

GB/T 4208-2017 Degrees of protection provided by enclosure (IP code)

GB 4785 Prescription for installation of the external lighting and light-signaling devices for motor vehicles and their trailers

GB/T 7593 Powered industrial trucks - Symbols for operator controls and other displays

GB/T 7939 Hydraulic fluid power - Hose assemblies - Test methods

GB/T 9286-1998 Paints and varnishes - Cross cut test for films

preventing the pressure in the system from exceeding a predetermined value. The device shall be designed and installed, to prevent accidental loosening or adjustment. A tool or key is required to adjust the pressure.

5.1.8 There shall be no sharp edges and corners in the normal driving position of the operator AND within the scope of entering and exiting the operating platform.

5.1.9 The exposed surface of the towing tractor shall be smooth and beautiful. The paint shall be even and free from defects, such as cracks, peeling, accumulation, foaming.

5.1.10 The towing tractor shall be tested according to the provisions of GB/T 9286-1998. The adhesion of the paint film shall not be lower than the secondary quality requirements.

5.1.11 The maximum operating speed of walk-on battery towing tractors shall not exceed 4 km/h (speed not adjustable) or 6 km/h (speed adjustable). The maximum operating speed -- of the stand-on battery towing tractor and the walk-on battery towing tractor which has a folded plate for the operator to stand on -- shall not be greater than 16 km/h.

5.2 Performance requirements

5.2.1 Steering performance

5.2.1.1 In-situ steering force of the steering wheel

5.2.1.1.1 The steering shall be light and flexible. When turning a towing tractor with power steering, the steering force acting on the steering wheel shall be 8 N ~ 25 N, the difference between left and right steering shall not exceed 10 N. When the towing tractor is running straight at the maximum speed, there shall be no obvious snaking phenomenon.

5.2.1.1.2 When the towing tractor without power steering or assisted steering is parked, the steering wheel is in the straight-line driving position; the steering force of operating the steering wheel to the left (or right), for the first half turn, shall not exceed 177 N. Thereafter, the steering force during turning to the left (or right) limit position shall not exceed 355 N; the maximum free rotation angle of the steering wheel to the left (or right) shall not exceed 15°; the maximum rotation angle of the steering wheel to the left (or right) shall not exceed 1080°.

5.2.1.2 Turning performance of right-angle passage

When the towing tractor passes through the prescribed right-angle passage to the left and right, it shall pass successfully at one time; it shall not back up during the turning process. If the towing tractor fails to turn successfully through the right-angle passage, it is allowed to do it again, but it shall not exceed 3 times.

5.2.2 Traction performance

Comparing the measured traction force-operating speed characteristic curve of an internal combustion towing tractor with the design curve, the difference between the traction force, at the same operating speed, shall not exceed $\pm 10\%$. Comparing the measured traction force-operating speed characteristic curve of a battery towing tractor with the design curve, the traction force difference, under the operating current of the traction motor, shall not exceed $\pm 10\%$.

5.2.3 Braking performance

The performance of the tractor brake shall comply with the provisions of GB/T 18849. When the combination tractor runs on a slope greater than 10%, it shall be considered that the trailer has a braking function in the design.

5.2.4 Energy consumption

The continuous driving time and the mileage of a single charge of the battery towing tractor shall not be less than the design value.

5.2.5 Rainproof sealing performance

After the rain test of a towing tractor with a cab, the score according to QC/T 476 shall not be less than 80 points. The operator shall operate the vehicle immediately and it shall be able to operate normally; all systems and components shall function normally. After the rain test of open towing tractor rain, the operator shall operate the vehicle immediately and it shall be able to run normally; all systems and components shall function normally.

5.3 Electrical requirements

5.3.1 The electrical system of the towing tractor shall meet the requirements of GB/T 27544.

5.3.2 The insulation class of the motor shall not be lower than Class F.

5.3.3 The design of the battery towing tractor shall ensure that the towing tractor cannot start when charging.

5.3.4 The traction motor shall preferably adopt the S₂₆₀ min or S₁ working system. The degree of protection of the traction motor shall not be lower than the IP54 in GB/T 4208-2017. The traction motor shall be able to bear the force and current load in the test, which is specified in Chapter 6 of this standard. The combined stress and temperature rise shall not cause any component failure and excessive deformation, but the common fading of the commutator of the motor shall not be included.

shall be calculated, according to the sound pressure level; its value shall not be greater than 75 dB (A).

5.4.19 Hybrid towing tractors shall meet the noise requirements, in different power transmission modes.

5.4.20 When the hybrid towing tractor is parked and the key switch is in the "off" position, the vehicle must not automatically start the engine to charge the traction battery.

5.4.21 Other safety requirements of the towing tractor shall meet the provisions of GB/T 10827.1.

5.4.22 The hybrid towing tractor shall meet the technical requirements, under different working modes.

5.5 Safety requirements for LPG towing tractors

Containers, pipelines, equipment for liquefied petroleum gas shall comply with the provisions of GB/T 10827.1.

5.6 Safety requirements for natural gas towing tractors

5.6.1 Containers

5.6.1.1 Steel cylinders shall be reliably fixed on the vehicle. The fixed seat for installing the steel cylinder shall have the ability to prevent the steel cylinder from rotating and moving; the fixed seat shall be easy to disassemble. After the steel cylinder is installed on the vehicle, the serial number of the steel cylinder shall be easy to see; the strength and rigidity of the steel cylinder shall not be reduced; the structural strength of the frame (body) shall not be affected.

5.6.1.2 A rubber pad, which has a thickness of not less than 2 mm, shall be placed between the steel cylinder and the fixing seat; the fixing bolts shall have anti-loosening devices.

5.6.1.3 The installation of steel cylinders shall be reasonably and neatly arranged. After the steel cylinder is installed, it shall not exceed the outer contour edge of the vehicle; the distance from the exhaust pipe of the towing tractor shall not be less than 200 mm. When the distance is less than 200 mm, a reliable heat insulation device shall be installed. The distance from the steel cylinder valve to the outermost edge of the vehicle at both sides shall not be less than 200 mm.

5.6.1.4 Steel cylinders shall not be installed directly in the cab.

5.6.1.5 Steel cylinders shall be installed in a ventilated position OR effective ventilation measures shall be taken; the gas leaked from the valve shall not be directly discharged into the driver's cab or passenger compartment.

5.6.2 Piping

5.6.2.1 The pipelines shall be neatly arranged reasonably arranged. The pipelines and power circuits shall be separated. The pipelines shall be under the power circuits AND shall not collide or rub against adjacent components.

5.6.2.2 The special parts of the high-pressure hose (such as between relatively moving parts) shall adopt flexible pipelines; the other parts shall adopt rigid connections.

5.6.2.3 The distance between rigid pipeline fixing clips shall not be greater than 600 mm. The spacing between flexible hose fixing clips is not more than 300 mm. If the pipeline is in contact with adjacent components or passes through the orifice plate, rubber sleeves shall be used for protection. Anti-vibration measures shall be taken for pipelines, to eliminate the effects of thermal expansion and contraction. The central curvature radius of the hose shall not be less than 5 times the outer diameter of the pipeline.

5.6.2.4 There shall be no leakage at the connection -- between the high-pressure fuel pipe and the joint. The airtightness shall be tested according to the test method specified in the foaming liquid test method.

5.6.2.5 The high-pressure hose and all joints of the compressed natural gas towing tractor shall be able to withstand a test pressure of 30 MPa; the hose shall not leak when the pressure is maintained for 10 minutes; when the test pressure is 45 MPa, the hose will not burst.

5.6.2.6 The low-pressure hose and circulating water hose of the LNG towing tractor shall be suitable for 2 times the working pressure, meanwhile withstand 4 times the working pressure without bursting.

5.6.2.7 Rigid fuel piping shall be made of seamless stainless steel pipes or copper pipes.

5.6.3 Equipment

5.6.3.1 The pressure gauge shall be installed in a position that is easy to observe. The pressure gauge and air pressure (volume) sensor shall not be installed directly in the cab. When installed in an exposed position, a protective cover shall be installed. The air pressure (volume) display shall be installed at a position, which is easy for the operator to observe in the cab.

5.6.3.2 The liquid level indicator of the liquefied natural gas towing tractor shall be installed in a position, that is easy to observe. The electrical connector of the liquid level indicator shall be subject to waterproof and anti-loosening treatment. The connection

the technical conditions of the vehicle.

6.1.2 Before the test, the fuel, lubricating oil, hydraulic oil, coolant shall be filled up as required.

6.1.3 Towing tractor tires shall meet the following requirements:

- a) The air pressure of the inflated tire shall meet the specified value; the air pressure deviation is ± 0.02 MPa;
- b) Solid tires shall comply with the technical conditions of the vehicle or the relevant technical conditions. The hardness difference -- between the two tires on the same axle of the front and rear axles -- shall not exceed 5 degrees of Shore hardness.

6.1.4 During the whole test period, the towing tractor shall be technically serviced and maintained, according to the operation and maintenance instructions; no arbitrary adjustment, replacement, maintenance or repair is allowed. Maintenance and repair work shall be recorded in detail.

6.1.5 The towing tractor shall be fully warmed up, before the performance test, and meet the following conditions:

- a) The engine's outlet water temperature is not lower than 70 °C;
- b) The engine's oil temperature is not lower than 60 °C;
- c) The hydraulic oil temperature of the torque converter shall not be lower than 80 °C.

6.1.6 The test environment shall meet the following conditions:

- a) The air temperature is -20 °C ~ 40 °C;
- b) The wind speed is not greater than 5 m/s;
- c) The maximum relative humidity of the air is not more than 90% (when the temperature is 20 °C);
- d) The altitude shall not exceed 2000 m.

6.1.7 The test site shall meet the following requirements:

- a) Test site: Flat, dry, clean concrete or asphalt road surface, with a slope not greater than 0.5%;
- b) Straight test runway: Flat, dry, clean concrete or asphalt pavement, the length of the runway is not less than 200 m, the width is not less than 5 m, the longitudinal slope is not more than 0.5%.

6.1.8 During the towing tractor test, the operator's weight is calculated as 90 kg; if it is not enough, use the counterweight to compensate.

6.2 Visual inspection

Visual inspection methods include visual inspection, ear hearing, hand touching, sniffing, knocking, etc., as well as measurement with conventional measuring tools.

Generally, the towing tractor does not need to be disassembled for visual inspection.

6.3 Measurement of main structural dimensions

The main structural dimensions of the towing tractor shall be measured, according to the method specified in 6.1 of JB/T 3300-2010.

6.4 Determination of main technical performance parameters

The determination of the unladen mass and bridge load of the tractor shall be carried out, according to the method specified in 6.2 of JB/T 3300-2010.

6.5 Paint film adhesion test

The towing tractor's paint film adhesion test shall be carried out, according to the method specified in GB/T 9286-1998.

6.6 Steering performance

6.6.1 Determination of steering wheel's in-situ steering force

The towing tractor is in a parked state; the engine of an internal combustion towing tractor is idling OR the steering motor of a battery towing tractor is in a starting state. Slowly turn the steering wheel; the steering wheel turns to the maximum turning angle, starting from the straight-line driving position; use the steering parameter tester, to measure the in-situ steering force of the steering wheel; carry out twice in each of the left and right directions; take the average value respectively.

6.6.2 Right-angle passage turning test

Depending on the type of towing tractor, the towing tractor shall turn through a right-angle passage of the following width:

- a) Category I: When the maximum tow force is ≤ 8.9 kN, the right-angle passage

Make the towing tractor tows the load measurement vehicle to drive, use the load measuring vehicle to load, after reaching the maximum stable vehicle speed, so that the speed of the towing tractor decreases steadily, until it reaches the minimum stable speed. During the test sampling process, the vehicle speed shall be stable for 20 s or 20 m (take the longer time of the two). Use the instrument to simultaneously and synchronously collect the entire test record. Draw the traction force-running speed characteristic curve, traction force-motor operating current characteristic curve.

The traction characteristics of the hybrid towing tractor are measured separately, in different power modes.

6.8.2 Determination of maximum tow force

On the test site, a tension sensor is installed, between the towing tractor and the load measuring vehicle. The height of the center of the load measuring vehicle's hook from the ground shall be consistent with the height of the center of the towing tractor's hook from the ground. Make the towing tractor drive at the lowest gear and the maximum running speed; after the speed is stable, use the load measuring vehicle to load, so that the speed of the towing tractor decreases smoothly. For internal combustion towing tractors, it shall take sample, after stabling for 3 s before the engine is turned off (for hydraulic transmission towing tractors, they are in the torque converter stall state) or when the driving wheels are completely slipping. For battery towing tractors, it shall take sample, when the traction motor is stabilized for 3 s at 5min working system at maximum allowable current, or in case of governor's over-current protection, the traction motor is blocked, or the driving wheel is slipping. Use an instrument, to record the traction force at this speed.

The test is carried out twice each time. Take the average value.

For the hybrid towing tractor, measure the maximum tow force, in different power modes respectively.

6.8.3 Determination of rated tow force

On the test site, a tension sensor is installed, between the towing tractor and the load measuring vehicle. The height of the center of the load measuring vehicle's hook from the ground shall be consistent with the height of the center of the tractor's hook from the ground. Make the towing tractor drive at the lowest gear and the maximum running speed; after the speed is stable, use the load measuring vehicle to load, so that the speed of the towing tractor decreases smoothly. The internal combustion towing tractor shall run stably, at no less than 10% of the maximum operating speed (the tractor has no trailer); for the battery towing tractor, it shall conduct sampling until the working current of the traction motor stabilizes to the rated current of the 1h working system. During the test sampling process, the vehicle speed shall be stable for 20 s or 20 m (whichever is longer); use the instrument to record the traction force at this speed.

6.10.2 Driving mileage test for one charge

The battery pack is fully charged. The density of the electrolyte is $1.280 \text{ g/cm}^3 \pm 0.005 \text{ g/cm}^3$ (at $25 \text{ }^\circ\text{C}$) or according to the manufacturer's requirements. The tractor tows 50% of the rated load, to drive at the maximum operating speed, along the route as shown in Figure 2 (the route does not pass through ramps and obstacles), until the power indicator light on the display instrument starts to warn. Record the mileage traveled.

6.11 Rain test

6.11.1 Preparations before test

Park the towing tractor at the designated location in the rain-spraying site. The test personnel enter the compartment. Close all the doors, windows, opening covers. Start the rain-spraying equipment. Start timing the test, after the rain-spraying state stabilizes.

6.11.2 Rain test of tractor with cab

6.11.2.1 Rain test of front windshield of cab

The rain intensity is $(12 \pm 1) \text{ mm/min}$. The spray is at an angle of $30^\circ \sim 45^\circ$ to the vertical direction. The nozzle faces the front windshield, at a distance from the front windshield of $700 \text{ mm} \sim 800 \text{ mm}$. The rain time is 15 minutes.

6.11.2.2 Cab door/window and vehicle body rain test

The rain intensity is $(8 \pm 1) \text{ mm/min}$. The spray angle is $30^\circ \sim 45^\circ$ from the vertical direction. The nozzle faces the door, window, vehicle body, at a distance from the door, window, vehicle body of $700 \text{ mm} \sim 800 \text{ mm}$. The raining time is 15 minutes.

6.11.3 Rain test of open towing tractor

The rain intensity is $(8 \pm 1) \text{ mm/min}$. The axes of the front, rear, side nozzles form an included angle of $30^\circ \sim 45^\circ$, with the vertical direction. The axis of the top nozzles is consistent with the vertical direction. The nozzles face the top of the vehicle body, side enclosure. The distance from the nozzle to the top of the vehicle body and the side enclosure is $800 \text{ mm} \sim 1000 \text{ mm}$. The raining time is 15 minutes.

6.12 Electrical control system test

The test of the electrical control system of the towing tractor shall be carried out, according to the method specified in GB/T 27544.

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