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**Powered industrial trucks - Brake performance and
component strength**

机动工业车辆 制动器性能和零件强度

(ISO 6292:2020, Powered industrial trucks and tractors - Brake performance
and component strength, IDT)

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Powered industrial trucks - Brake performance and component strength

1 Scope

This document specifies the performance, test methods, operating controls, operating force and component strength for brake systems fitted to the following industrial trucks, as defined in ISO 5053-1:

- powered industrial trucks of various lifting capacity/load capacity;
- towing and pushing tractors with a drawbar pull not greater than 66 750 N (hereinafter referred to as “industrial tractors”);
- burden carriers;
- industrial trucks handling freight containers.

This document does not apply to power outages and any other auxiliary power outages, nor does it apply to braking in emergency situations (such as turning on the emergency switch or shutting down the control system).

This document applies only to newly manufactured trucks.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1

braking force

Force in a direction opposite to the truck’s movement speed or movement trend, which is generated between the wheel and the ground contact surface through the action of the braking system (3.3).

[Source: GB/T 5620-2020, 9.11.3]

3.2

Foreseeable minimum mass of an unladen truck in the intended use of the truck, considering various combinations of optional attachments.

3.13

drawbar drag

Steady-state braking force (3.1) that can be applied to the ground by the mechanical braking system (3.3) at a given speed.

4 Requirements

4.1 Required braking systems

The truck shall have the following braking systems:

- a service braking system;
- a parking braking system.

4.2 Operating means

The service braking system and the parking braking system shall be operated by separate systems. The two sets of braking systems can use the same braking components, such as brake shoes, brake drums and related transmission parts. This requirement does not apply to independent braking systems fitted to trucks with stand-up and walk-up controls as defined in ISO 3691-1.

4.3 Service braking system

The service braking system shall comply with the following requirements:

- stopping distance test (see 6.3.1) and heat fade test (see 6.5.2);
- drawbar drag test (see 6.3.2) and heat fade test (see 6.5.3); or
- optional test procedure, such as calculation (see 6.3.3), and heat fade test simulation (see 6.5).

4.4 Parking braking system

The parking braking system shall meet the requirements of 6.2.

4.5 Brake operating forces

4.5.1 Under the conditions of 6.2 and 6.3.1 or 6.3.2, the operating force of the brake shall not be greater than the values specified in 4.5.2 ~ 4.5.6 and Table 1.

Note: Other types of brake operation may exist.

4.5.2 For brakes that achieve braking by moving the brake pedal downward (depressing the pedal), the required service braking performance and parking braking performance shall be achieved using an operating force of no more than 450 N.

4.5.3 For brakes that achieve braking by moving the brake pedal upward (releasing the pedal), when the brake pedal is completely released, the required service braking performance and parking braking performance shall be achieved. When traveling, the operating force required to fully depress the brake pedal to release the brake shall not be greater than 200 N.

4.5.4 For brakes that achieve braking by operating the handle, applying an operating force of no more than 300 N to the gripping point of the handle shall be able to achieve the required parking braking performance.

4.5.5 For brakes that achieve braking by gripping the handle, applying an operating force of no more than 150 N to the gripping point of the handle shall be able to achieve the required service braking performance.

4.5.6 For brakes that achieve braking by enabling the steering lever from the offset position to the vertical position (such as on a pedestrian-controlled truck), applying an operating force of no more than 150 N to the middle position of the steering lever hand-gripping position to make the spring of the steering lever in the maximum compression stroke position shall achieve the required service braking performance.

4.6 Brake component strength

4.6.1 The brake component strength shall not be lower than the values specified in 4.6.2 ~ 4.6.6 and Table 1.

4.6.2 For trucks that achieve service or parking brake by moving the brake pedal downward (depressing the brake pedal), the braking system shall be able to withstand an operating force of at least 1 200 N without any damage, cracks or deformation that affects the braking performance or function.

4.6.3 For trucks that achieve service or parking braking by moving the brake pedal upward (releasing the brake pedal), the braking system (including the upper limiting device) shall be able to withstand 200% of the maximum setting force of the spring of the band-type brake without any damage, cracks or deformation that affects the braking performance or function.

When the brake pedal is fully depressed, the brake pedal and its associated lower limiting device shall be able to withstand the operating force of 1 800 N acting on the middle part of the brake pedal transmission surface without any damage, cracks or deformation that affects the braking performance or function.

times/min, the pneumatic service braking system shall be able to provide a pressure of 70% of the maximum system pressure measured at the brake.

4.7.1.2 Braking system with hydraulic accumulator

The capacity of the hydraulic accumulator charging system shall be designed such that when the service brake is fully applied at a braking frequency of once every 5 seconds, the pressure in the accumulator is not less than the pressure required for meeting the braking performance of 6.3.1 or 6.3.2. For internal combustion trucks (IC), the test shall be conducted when the truck is stationary and idling. The test time shall be at least 2 minutes.

4.7.2 Energy storage failure alarm device

The service braking system utilizing stored energy for braking shall be equipped with an alarm device that will be triggered before the stored energy fails to meet the braking performance requirements specified in 6.3. The device shall be clearly visible or audible to the operator and shall provide a continuous alarm signal when triggered. The use of instruments solely indicating pressure or vacuum to meet the above requirements is not permitted.

The triggering pressure of the alarm device shall be set such that the truck can still meet the braking requirements of 6.3.1 or 6.3.2 under this pressure. This requirement does not apply to other hydraulic service braking systems, such as dual-circuit braking system.

After an alarm occurs, the truck shall have sufficient energy storage to meet the requirements of 6.3.1.

When the alarm is triggered, the truck shall be able to automatically limit the speed.

5 Test conditions

5.1 General

5.1.1 When conducting performance tests, the manufacturer's precautions shall be followed.

5.1.2 The test site shall be hard and dry concrete, asphalt or equivalent pavement.

The transverse slope of the test site perpendicular to the traveling direction shall not be greater than 2%. The longitudinal slope range along the direction of travel shall be $\pm 0.5\%$.

5.1.3 For full-load conditions, the truck shall be tested at the rated lifting capacity/load capacity, where the load center is placed at the location recommended by the

manufacturer. The mast or forks shall be fully tilted back or fully retracted (if the truck is designed to provide this feature).

The load can be fixed on the truck during the test.

5.1.4 The industrial tractor shall be tested in an unloaded mass state or without a trailer.

5.1.5 The truck mass and axle load distribution shall be measured and recorded.

5.1.6 The manufacturer's instructions shall cover all parameters relevant to the braking system, i.e. tire size and pressure, brake lining burnishing or adjustment. During each performance test, no manual adjustments shall be made to the braking system.

5.1.7 If the truck is equipped with a booster (brake servo mechanism), the mechanism shall be in working condition.

5.1.8 The brake may be subject to lining burnishing or adjustment before the test.

5.1.9 Before the test, the truck shall be operated so that the fluids in the truck (such as engine oil and transmission oil) are at the normal operating temperature specified by the manufacturer.

5.1.10 Before performing performance tests on parking brakes in accordance with 6.2 and performance tests on service brakes in accordance with 6.3, the brakes shall be cold brakes.

5.2 Stopping distance test

5.2.1 The guide road section entering the test site shall be of sufficient length, and even and smooth; it shall be ensured that the truck has reached the test speed before braking.

5.2.2 When the truck transmission provides speed ratio selection, the test shall be conducted in the transmission gear corresponding to the specified test speed.

The drive system can be disconnected before the truck comes to a complete stop.

5.2.3 The test speed of the truck shall be measured immediately before the braking operation is implemented.

5.3 Drawbar drag test

5.3.1 The drawbar drag test is only applicable when the braking component being tested is a mechanical brake (such as disc or drum) and the brake reaction time is not greater than 0.54 s.

Note: See ISO/TR 29944 for details of brake reaction time.

5.3.2 The drawbar drag method shall meet the following requirements:

- a) Measure the drawbar drag in the forward and backward directions, while pulling in both directions at a speed not exceeding 1.6 km/h;
- b) The drawbar shall be kept basically horizontal and connected at a point recommended by the manufacturer.

For trucks whose rated lifting capacity/load capacity is not more than 16 000 kg, the drawbar shall be connected at the approximate vertical center of gravity of the truck/load combination, but shall not exceed 900 mm above the test surface.

For trucks whose rated lifting capacity/load capacity is greater than 16 000 kg, the drawbar shall be connected at the approximate vertical center of gravity of the truck/load combination.

5.3.3 The operating control device shall be placed in the neutral position and the parking brake shall be fully released. Except where the service brake and parking brake use the same braking device.

6 Performance tests

6.1 General

Trucks of all configurations and working conditions (such as laden mass, unladen mass, different battery masses, attachment and mast heights, etc.) shall meet the performance test requirements.

6.2 Parking braking system performance

6.2.1 The performance of the parking braking system shall be tested in all traveling directions of the truck.

6.2.2 Without operator assistance, the parking braking system shall be able to park the truck on the following slope or the slope specified by the manufacturer (whichever is greater):

- a) Trucks whose operating position is lifted to more than 500 mm and trucks specially designed to operate with a lifted load: 5%;

Note: This requirement does not include trucks handling freight containers.

- b) Platform and stillage trucks, pallet trucks, platform stackers, pallet stackers, low-lift order-picking trucks with a lift height less than 500 mm, straddle trucks, reach trucks, bi-directional lift trucks, multi-directional lift trucks, industrial pedestrian-controlled trucks and pedestrian-controlled tractors: 10%;
- c) Other sit-on or stand-on industrial trucks or industrial tractors: 15%.

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