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**Earth-moving machinery - Crawler machines - Performance
requirements and test procedures for braking systems**

土方机械 履带式机器 制动系统的性能要求和试验方法

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1 Scope

This standard sets the minimum performance requirements and the test methods for the braking systems of crawler machines, so that the service braking, the secondary braking and the parking braking of these machines can be assessed on a uniform basis.

This standard applies to self-propelled crawler machines as defined in GB/T 8498 whose maximum design speed is not greater than 20 km/h, and it also covers derivative earth-moving machines running on rubber tracks.

This standard does not apply to the machines defined in GB/T 25609 or to wheeled machines fitted with over-tracks. Crawler machines whose maximum design speed is greater than 20 km/h are to use GB/T 21152.

2 Normative references

The following documents are indispensable for the application of this document. For dated references only the edition corresponding to that date applies; for undated references the latest edition, including all amendments, applies.

ISO 6014 Earth-moving machinery - Determination of ground speed; ISO 6016 Earth-moving machinery - Methods of measuring the masses of whole machines, their equipment and components; ISO 9248 Earth-moving machinery - Units for dimensions, performance and capacities, and their measurement accuracies.

ISO 10266 Earth-moving machinery - Determination of slope limits for machine fluid systems operation; ISO 10968 Earth-moving machinery - Operator's controls; ISO 15998 Earth-moving machinery - Machine-control systems (MCS) using electronic components - Performance criteria and tests for functional safety.

The foreword lists the Chinese documents that correspond to the international ones cited: GB/T 8595-2008 (ISO 10968:2004, IDT), GB/T 10913-2005 (ISO 6014:1986, MOD), GB/T 21153-2007 (ISO 9248:1992, MOD), GB/T 21154-2014 (ISO 6016:2008, IDT) and GB/T 25611-2010 (ISO 10266:1992, IDT).

3 Terms and definitions

The following terms and definitions apply to this document.

3.1 Brake systems. 3.1.1 brake system - All the parts that brake the machine and, or, hold it stopped. 3.1.2 service brake system - The main braking system used to brake the machine and bring it to a stop. 3.1.3 secondary brake system - The system that brakes the machine when the service brake system fails. 3.1.4 parking brake system - The system that keeps a machine that has already been braked standing still in place.

3.2 Brake system components. 3.2.1 control - The device operated directly by the operator, whose function is to produce an actuating force, a braking signal or a braking command and to pass it to the brake. 3.2.2 brake actuation system - All the parts placed between the brake control and the brake that functionally connect the two. 3.2.3 brake - The device that applies a force directly in order to stop the movement of the machine. Note: brakes can be of several kinds, such as friction, electric, regenerative, retarder, hydraulic or other hydro-pneumatic types.

3.3 brake retarding force - The retarding force or holding force produced on the machine by the action of the brake system together with the rolling resistance, excluding any braking effect produced by the engine, that is the engine brake, the retarder and the exhaust brake. Note: in practice this force is measured by connecting the machine under test with a rope to a towing or anchored machine or piece of equipment.

3.4 common component - A part that carries out the same function in two or more brake systems.

3.5 machine mass, M - The operating mass of the machine, which includes the operator's cab, the machine housing and the operator protective structure and, where required, the heaviest combination of the working attachments allowed by the manufacturer together with all their structural and mounting parts, and the payload required by ISO 6016.

3.6 slope capability - The slope on which the braking performance of a particular machine is determined, between 17° and 45°, or the travel working slope laid down by the manufacturer, between 17° and 45°.

3.7 back throttling - The function of applying a small forward or rearward force to a hydrostatic drive system or a similar propulsion drive system so as to hold the machine stopped on a slope.

3.8 modulated braking - The performance by which the operator, acting on the brake control, can increase or decrease the braking force continuously or progressively, that is braking or deceleration through a combination of hand and foot, or other variations.

3.9 maximum machine level surface speed - The machine speed determined in accordance with ISO 6014 or an equivalent standard.

3.10 derivative earth-moving machine - Other earth-moving machinery having the characteristic shape of earth-moving machinery and produced by a different structure or arrangement, for example an excavator-loader in which four separate rubber tracks take the place of the four tyres.

3.11 safe state - The state reached after a failure of the machine control system, which avoids the potential hazard of an unintended movement of the machine or of a release of stored energy.

3.12 hydrostatic drive system - The hydraulic system that propels the machine and stops its movement.

3.13 brake slope capability - The maximum holding slope angle declared by the machine manufacturer, at which the service brake can bring the machine to a stop and the service brake and the parking brake can keep the machine standing still in place; the smaller of the two slope values is taken.

4 Requirements

4.1.1 Function. Every machine has to be provided with the following brake systems: a service brake system; a secondary brake system; a parking brake system. Note: the service brake system, the secondary brake system and the parking brake system can share common components and need not be three independent and separate systems; 4.3 gives the performance requirements that apply if any one component fails.

4.1.2.1 Disengaging devices, general. The brake system must not contain disengaging devices, such as a clutch or a gear-shift transmission, able to make the brake fail, apart from the devices allowed in 4.1.2.2 and 4.1.2.3.

4.1.2.2 Parking brake disengaging device. A device that lets an already braked machine be moved has to be placed outside the operator's position, unless the parking brake can be operated again directly from inside the operator's position.

4.1.2.3 Service brake or secondary brake disengaging device. When starting in cold weather, where a device is used to disengage the power source of the service brake or of the secondary brake, the parking brake has to be applied before that service brake or secondary brake is disengaged.

4.2.1 Brake controls, general. All the brake system controls have to be operable by the operator from the seat. The parking brake system control has to be such that, once braking has been applied, it cannot be disengaged unless the operator operates it again. The brake controls are arranged as laid down in ISO 10968.

4.2.2 Automatic application. The secondary brake system and the parking brake system may be applied automatically, for example by a live spring, and automatic application does not have to be controlled.

4.2.3 Control force. When the required brake system performance is tested, see Table 2, the control forces of the brake controls have to comply with Table 1. Table 1 fixes a maximum control force in newtons for each form of control: 20 N for finger control by finger levers and switches; 400 N for hand control moved upwards; 300 N for hand control moved fore and aft, sideways or downwards; 350 N for a foot pedal operated by the ankle; 600 N for a foot pedal operated by the leg.

4.3 Common components. The brake systems, in their service, secondary and parking functions, may use common components. However, the failure of any single component must not bring the braking performance of the machine below the secondary brake system performance laid down in 6.1.4.

4.4 Warning device for an exhaustible energy source. If an exhaustible energy source is used for the service brake system, that exhaustible energy system has to carry a warning device. The warning device has to give a warning before the system energy falls to or below either 50 % of the maximum working energy declared by the manufacturer, or the value of exhaustible energy needed to meet the secondary brake system performance requirements of 6.1.4.