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

Engins de terrassement — Engins à chenilles — Exigences de performance et modes opératoires d'essai des dispositifs de freinage

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 10265 was prepared by Technical Committee ISO/TC 127, *Earth-moving machinery*, Subcommittee SC 1, *Test methods relating to machine performance*.

This second edition cancels and replaces the first edition (ISO 10265:1998), which has been technically revised.

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

1 Scope

This International Standard specifies minimum performance criteria and test methods to enable uniform assessment of the service, secondary and parking brake systems of crawler machines.

It is applicable to self-propelled crawler machines, as defined in ISO 6165 including derivative earth-moving machines with rubber tracks, with a maximum design speed of 20 km/h or less. This International Standard does not cover those machines that are covered by ISO 17063 or wheeled machines equipped with over-the-tyre tracks. Crawler machines with maximum design speed greater than 20 km/h conform to ISO 3450.

NOTE Crawler machines used in underground mining applications might have other regional or local brake system requirements.

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.

ISO 6014:1986, *Earth-moving machinery — Determination of ground speed*

ISO 6016:1998, *Earth-moving machinery — Methods of measuring the masses of whole machines, their equipment and components*

ISO 9248:1992, *Earth-moving machinery — Units for dimensions, performance and capacities and their measurement accuracies*

ISO 10266:1992, *Earth-moving machinery — Determination of slope limits for machine fluid systems operation — Static test method*

ISO 10968:2004, *Earth-moving machinery — Operator's controls*

ISO 15998:—[1)], *Earth-moving machinery — Machine-control system (MCS) using electronic components — Performance criteria and tests for functional safety*

3 Terms and definitions

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

3.1 Brake systems

1) To be published.

3.1.1
brake system
all the components that combine to stop and/or hold the machine, including the control(s), the brake actuation system, the brake(s) and all parts connecting the brake to the track

3.1.2
service brake system
primary system used for stopping and holding the machine

3.1.3
secondary brake system
system used for stopping the machine in the event of any single failure in the service brake system

3.1.4
parking brake system
system used to hold a stopped machine in a stationary position

3.2 Brake system components

3.2.1
control
component directly activated by the operator to cause a force, a braking signal or braking request to be transmitted to the brake(s)

3.2.2
brake actuation system
all the components between the control(s) and the brake(s) which connect(s) them functionally

3.2.3
brake
components that directly apply a force to oppose movement of the machine

NOTE Brakes can, for example, be of friction, electrical, regenerative device, hydrostatic or other fluid types.

3.3
brake retarding force
decelerating or holding force due to brake system action plus rolling resistance, but excluding any braking effect by the engine (i.e., engine brakes, retarders, exhaust brakes)

NOTE In practice, this is the force measured in a line connecting the machine being tested to a pulling or anchoring machine or device.

3.4
common component
component that performs a function in two or more brake systems

3.5
machine mass
M
operating mass of a machine which includes the heaviest combination of cab, canopy, operator protective structures, if required, with all their components and mountings, any combination of equipment approved by the manufacturer of the machine, including operator and full liquid systems in accordance with ISO 6016

NOTE The machine mass for crawler tractors (i.e., machines with integrated buckets, bins, bowls which typically travel with a load) is to include a payload.

3.6
slope capability
α
slope that establishes brake performance for a specific machine between the minimum 17° and maximum 45° criteria or the maximum slope specified by the manufacturer for travel or operation between 17° and 45°

3.7
back throttling
action of applying slight forward or reverse power to a hydrostatic drive system or similar propel drive systems to hold the machine stationary on a slope

3.8
modulated braking
capability to continuously and progressively increase and decrease the braking force by operation of the brake control (i.e., hand, foot, combined brake/deceleration or other variations)

3.9
maximum machine level surface speed
maximum speed determined in accordance with ISO 6014, or equivalent

3.10
derivative earth-moving machine
earth-moving machine forms that are a combination of features from other earth-moving machines creating different configurations or arrangements (e.g., backhoe loader with four separate rubber tracks replacing four wheels)

3.11
safe state
state in which the controlled equipment, process, or system is automatically or manually stopped or switched into a mode to prevent unexpected movements or potentially hazardous release of stored energy, after a malfunction of the machine-control system

3.12
hydrostatic drive system
closed loop hydraulic system to propel and retard machine movement

3.13
brake slope capability
maximum slope advertised by the machine manufacturer, on which the service brakes are capable of stopping the machine and the service and park brakes are each capable of holding the machine stationary, whichever is the least slope value

4 General requirements

4.1 Required brake systems

4.1.1 Functions

All machines shall be equipped with:

— a service brake system;

— a secondary brake system;

— a parking brake system.

NOTE Service, secondary and parking brake systems can share common components and do not have to be three independent and separate systems. Subclause 4.3 gives the required performance if there is any single component failure.

4.1.2 Disconnecting device

4.1.2.1 General

No brake system shall contain a disconnecting device, such as a clutch or shiftable gear box, which allows disabling the brake(s) with the exception of 4.1.2.2 and 4.1.2.3 which are permissible arrangements.

4.1.2.2 Parking brake disconnecting device

A parking brake disconnecting device designed to allow movement of a disabled machine shall be located outside the operator's station, unless the parking brake can be re-applied immediately from within the operator's station.

4.1.2.3 Service or secondary brake disconnecting device

Any device designed to disconnect the service or secondary brake power source for cold weather starting, shall require application of the parking brake before disconnecting the service or secondary brakes.

4.2 Brake controls

4.2.1 General

All brake system controls shall be capable of being applied by an operator from the operating position. Parking brake system's control(s) shall be arranged so that they cannot be released once they have been applied unless they can be immediately re-applied by the operator. Arrangement of brake controls is covered by ISO 10968.

Machines equipped with any brake system including an electronic brake control system shall prevent or minimize an uncontrolled braking performance (i.e., random brake applied, released or sporadic braking performance) during normal operation (e.g., during start, stop or normal travel operation of the machine) of the brake control systems.

4.2.2 Automatic application

Secondary and parking brake systems may be applied automatically (e.g., spring activated). Automatic application does not require modulation.

4.2.3 Control force

The force applied to the brake control shall not exceed the levels specified in Table 1 when the required brake system performance (see Table 2) is measured.

Table 1 — Maximum control force for brake tests

Control type	Maximum force applied N
Finger grasp (flip levers, switches)	20
Hand grasp:	
— upwards	400
— fore-aft, sideways, downward	300
Foot treadle (ankle control)	350
Foot pedal (leg control)	600

4.3 Common components

Brake systems (service, secondary and parking functions) may use common components. However, a failure of any single component shall not reduce the effectiveness of the machine's stopping capability to less than the secondary brake system performance, as defined in 6.1.4.

The failure of a common component (lever, pedal, switch, micro-processor, wiring harness, valves, etc.), that may be used to actuate one of the brake systems, is permitted, provided that the machine's stopping capability meets the secondary brake performance, as defined in 6.1.4, after the failure. This braking capability may be applied automatically and without modulation.

4.4 Warning device for exhaustible energy sources

If exhaustible energy is used for the service brake system, the exhaustible energy system shall be equipped with a warning device. The warning device shall activate before the system energy drops below the greater of the following:

— 50 % of the manufacturer's specified maximum operating energy level or

— the exhaustible energy level required to meet the secondary brake performance requirements, as defined in 6.1.4.

The warning device shall readily attract the operator's attention by providing a continuous visible and/or audible warning. Gauges indicating pressure or vacuum do not meet this requirement.

NOTE Mechanical springs are not considered to be an exhaustible energy source.

4.5 Braking systems with an electronic control system

The electronic control system of a brake system shall meet the safe state as determined by the manufacturer using risk assessment methodology. An electronic control system complying with ISO 15998 meets the requirements of this subclause.

If the maximum travel speed for the machine with an electronic control system is designer limited to 6 km/h, the safe state requirements defined in this subclause are fulfilled when any of the brake systems can meet the service brake performance requirements, as defined in 6.1.3.

NOTE 1 Safe state can be achieved with robust design, high reliability or emergency stop controls for failure modes where there are no practical means to provide advance warnings.

NOTE 2 Equivalent ISO or IEC electric/electronic control system safety standards such as ISO 15998 can be used to meet the safe state through risk assessments and control measures.

5 Test conditions

5.1 Test sites

5.1.1 Level test course

The test course shall be relatively flat and smooth with a slope no greater than 1 % in the direction of travel, or 3 % transversely. The course shall be of sufficient size, material and condition to provide the traction required for conducting the towing or pulling tests described in Clause 6. Moisture content of a soil test course shall be such that the mass of the test machine can be supported with only nominal sinkage.