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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 procédures d'essai des dispositifs de freinage

Reference numbe

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.

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.

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

International Organization for Standardization
Case postale 56 • CH-1211 Genève 20 • Switzerland
Internet central@iso.ch
X.400 c=ch; a=400net; p=iso; o=isocs; s=central

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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, with a maximum design speed of 20 km/h or less and machine mass of 100 000 kg or less.

2 Normative references

The following standards contain provisions, which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 5998:1986, *Earth-moving machinery — Rated operating load for crawler and wheel loaders*.

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 6165:1997, *Earth-moving machinery — Basic types — Vocabulary*.

ISO 7546:1983, *Earth-moving machinery — Loader and front loading excavator buckets — Volumetric ratings*.

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*.

3 Definitions

For the purposes of this International Standard, the following definitions apply.

3.1 Brake systems

3.1.1
brake system
all the components which combine together to stop and/or hold the machine, including the control(s), means of brake actuation, 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 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 them functionally

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

NOTE — Brakes may, for example, be of friction, electrical, hydrostatic or other fluid types.

3.3
brake retarding force
decelerating or holding force due to brake system action plus rolling resistance, but excluding engine torque

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, ROPS or FOPS with all their components and mountings, and equipment approved by the manufacturer of the machine

3.6
slope capability
α
slope which establishes brake performance for a specific machine between the minimum 17° and maximum 45° criteria

NOTE — See 6.1.3.

4 General requirements

4.1 Required brake systems

4.1.1 All machines shall be equipped with

— a service brake system,

— a secondary brake system, and

— a parking brake system.

4.1.2 No brake system shall contain a disconnecting device such as a clutch or shiftable gear box which allows disabling the brake(s).

4.1.2.1 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 reapplied immediately.

4.1.2.2 A power source disconnecting device designed for cold weather starting and for disabling a brake system shall require application of the parking brake prior to disconnection.

4.2 Brake controls

4.2.1 General

All brake system controls shall be capable of being applied by an operator from his position. The secondary and parking brake systems control(s) shall be arranged so that they cannot be released once they have been applied unless they can be immediately reapplied.

4.2.2 Automatic application

Secondary and parking brake systems may be applied automatically.

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.

4.3 Common components

Brake systems 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.

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)	700

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.

5.1.2 Alternate static test site

If the alternate static test of 6.1.2 is used, it may be conducted on the level test course or in a level laboratory setting. The test machine shall be set up to measure propel forces with tracks on a traction surface, or tracks secured to a ground surface, or axles connected to a dynamometer.

5.2 Test preparations

The machine mass (see 3.5) shall include the operator and full liquid systems in accordance with ISO 6016. The mass of loaders shall include a loaded bucket in accordance with ISO 7546, equal to the rated load as defined in ISO 5998.

All parameters relating to braking systems shall be within the machine manufacturer's specifications, i.e. brake adjustment, brake pressures, track tension, etc. No manual adjustment(s) shall be made to the brake system(s) during any single test.

Each brake test shall be performed without interference from another brake system.

Connections for towing or pulling shall be made as low as possible on the drawbar or other appropriate connecting point(s).

Blades, buckets, chains, dozers, and other equipment shall be carried in the transport or travel position recommended by the manufacturer.

Burnishing (conditioning) of brakes before testing is permissible. The burnishing procedure shall be indicated in the operator's manual for the machine and shall be verified by consultation with the machine manufacturer.

Immediately prior to a test, the machine shall be operated until the machine fluids, i.e. engine and transmission oils, are at the normal operating temperature specified by the manufacturer.

5.3 Instrumentation

Instrumentation to measure and record the test parameters within the accuracy specified in ISO 9248 shall be provided.

5.4 Towing or pulling means

A means (for example, another machine or winch) shall be provided to generate the brake retarding, towing or pulling force required by the performance tests described in clause 6.

6 Test and performance criteria for brake systems

6.1 Tests for service and secondary brakes

6.1.1 Towing test on level test course

The service and secondary brake performance is tested by towing the machine with the transmission control in neutral at a speed of 10 % to 40 % of the maximum level surface speed (see ISO 6014). The brake(s) shall be applied and the brake retarding (towing) and brake control forces shall be measured.

Machines designed with hydrostatic brakes or automatic brakes which apply when the transmission control is in the neutral position may be tested by driving at the same speed as the towing machine and then applying the brake system being tested by placing the appropriate control in the brake or neutral position.

6.1.2 Alternate static test for certain service and secondary brakes

Hydrostatic brakes, or similar brakes without friction material, which have equivalent retarding performance in both a stationary and moving mode, may be tested using a static test procedure (see 5.1.2).

The service brake performance is tested in a static mode by engaging propel to exert, for example, a pull against an anchor or to resist a pull from a winch. The resultant propel pulling force shall be considered to be the brake retarding force and no corrections are made for track or machine rolling resistance. The brake retarding (pulling) and brake control forces shall be measured.

6.1.3 Service brake performance criteria

Application of the service brake system in accordance with table 1 shall cause the test machine to develop a brake retarding force as specified in table 2 in both the forward and reverse directions.

Table 2 — Performance criteria for crawler brake systems

Brake system	Brake retarding force N
Service	9,8 M sin α
Secondary	4,9 M sin α
Parking	9,8 M sin α
NOTE — α is the slope capability angle, in degrees (see 3.6); M is the machine mass, in kilograms (see 3.5).	

The slope capability (α) is the maximum that the machine in transport mode and prepared in accordance with 5.2 can ascend unaided with a ground friction (traction) coefficient (μ) of 1,0. Brake performance shall be equivalent to the minimum 17° slope capability angle regardless of limitations for fluid system operation (see ISO 10266) or tipping or tractive pulling force.

6.1.4 Secondary brake performance criteria

Crawler machines have independent brakes for each track of nominally equal capacity. Application of the secondary brake system in accordance with table 1 shall cause at least one track on the moving test machine to develop a brake retarding force as specified in table 2 in both the forward and reverse directions.

6.2 Static pulling test for parking brake

6.2.1 Parking brake test

The parking brake performance is tested by pulling on the stationary test machine with the park brake applied and the transmission control in neutral. The static brake retarding (pulling) and brake control forces shall be measured.

6.2.2 Parking brake performance criteria

Application of the parking brake system in accordance with table 1 shall hold the test machine's tracks stopped and develop a static pulling force as specified in table 2 in both the forward and reverse directions.

6.2.3 Maintained application criteria

After application, the parking brake system shall maintain the parking brake performance, as specified in table 2, regardless of any contraction of the brake parts or leakage of any kind. This system shall not be dependent upon an exhaustible energy source.

7 Test report

The test report shall contain at least the following information:

a) reference to this International Standard;

b) the type of machine;

c) the make of the machine;

d) the model and serial number of the machine;

e) the condition of the brake system (e.g. new, in operation for 1 000 h);

f) the mass of the machine as tested in kilograms;

g) the manufacturer's approved maximum machine mass, in kilograms;

h) description of the brakes (e.g. disc, drum, hand or foot control);

i) the type of brake systems (e.g. mechanical, hydraulic, spring applied, hydrostatic);

j) the longitudinal and cross slope of the test course;

k) the results of all brake tests;

l) the force levels applied to the controls (see 4.2.3);

m) the test setup and method used for the alternative static test in 6.1.2;

n) the dimensions, construction and condition of the test course.