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Machinery for forestry — Tracked special machines — Performance criteria for brake systems

Matériel forestier — Machines spécifiques sur chenilles — Critères de performance 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.

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.

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Machinery for forestry — Tracked special machines — Performance criteria for brake systems

1 Scope

This International Standard specifies performance test methods and criteria to enable uniform assessment of the service, secondary and parking brake systems of tracked specially designed forestry machines.

This International Standard applies to self-propelled tracked special forestry machines defined in ISO 6814 with a maximum design speed, determined in accordance with ISO 6014, of 20 km/h 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 6014:1986, *Earth-moving machinery — Determination of ground speed.*

ISO 6814:1983, *Machinery for forestry — Mobile and self-propelled machinery — Identification vocabulary.*

3 Definitions

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

3.1 brake system: All the components which combine together to stop and/or hold the machine.

NOTE 1 Such systems include the control(s), means of brake actuation, the brake(s) and all parts connecting the brake to the track.

3.1.1 service brake system: Primary system used for stopping and holding the machine.

3.1.2 secondary brake system: System used for stopping the machine in the event of any single failure in the service brake system.

3.1.3 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 of 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 2 The brakes may, for example, be of friction, electrical or fluid types.

3.3 common component: Component that performs a function in two or more brake systems.

3.4 brake retarding force: Decelerating or holding force due to brake system action plus rolling resistance, but excluding engine torque.

NOTE 3 In practice, this is the force measured in the tow-line between a machine with the test brake(s) applied and a pulling machine.

3.5 machine mass, m: Mass of a machine including

— the heaviest combination of manufacturer-approved equipment (i.e. winch, dozer, felling head, grapple, etc.) and components (i.e. cab, protective structures, etc.);

— an operator of 75 kg;

— full fuel, lubricating, hydraulic and cooling systems;

— the manufacturer's rated payload, in the case of forwarders.

3.6 slope capability, α: Maximum slope, between 25° and 45°, which the machine in transport mode as specified in 5.2 can ascend unaided with a ground friction coefficient, μ, of 1, without exceeding its static tipping angle.

NOTE 4 The slope capability may be determined on a prepared slope, or by tractive pulling force as specified in 5.1, where α is calculated as follows:

$$\alpha = \arcsin \frac{F}{mg}$$

where

F is the pulling force, in newtons;

m is the machine mass (3.5), in kilograms;

g is the gravitational constant $\left(g = 9{,}81\ \text{m/s}^2\right)$.

4 General requirements

The following requirements for brake systems apply to all crawler machines specified in clause 1.

4.1 Required brake systems

4.1.1 All machines shall be equipped with

a) a service brake system;

b) a secondary brake system; and

c) a parking brake system.

4.1.2 No brake system shall contain a disconnecting device such as a clutch or shiftable gearbox which allows disabling of the brake(s). This requirement does not apply to devices specified in 4.1.3 and 4.1.4.

4.1.3 Brake disconnecting devices designed to allow movement of disabled machines shall be located outside the operator's station unless they can be reapplied immediately.

4.1.4 A power source disconnect designed for cold-weather starting which also disables 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 a person sitting in the operator's seat.

4.2.2 Release and reapplication

The secondary and parking brake system(s) control(s) shall be arranged so that they cannot be released from the operator's seat once they have been applied unless they can be reapplied immediately from the operator's seat.

4.2.3 Automatic application

Secondary and parking brake systems may be applied automatically.

4.2.4 Control forces

The force applied to the brake control shall not exceed the levels given in table 1 when the required brake system performance in table 3 is measured.

Table 1 — Maximum test force levels

Type of control	Force max. N
Finger grasp (flip levers, switches)	20
Hand grasp:	
— upwards	400
— fore-aft, sidearm pull, downward	300
Foot treadle (ankle control)	350
Foot pedal (leg control: power-assisted or not)	600

4.3 Common components

Brake systems may use common components; however, 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 6.1.2.

5 Test conditions

5.1 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, materials and conditions to provide the traction required for the towing and pulling tests in clause 6. The moisture content of the soil shall be such that the mass of the test machine can be supported with only nominal sinkage.

5.2 Test preparations

The machine mass shall be as specified in 3.5.

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

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

Blades, dozers, grapples, felling heads 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 normal operating temperature as specified by the manufacturer.

5.3 Instrumentation

Instrumentation to measure and record the parameters within the accuracy specified in table 2 shall be provided.

Table 2 — Instrument accuracy levels

Parameter measured	Accuracy %
Brake system pressure	± 2
Machine mass	± 2
Brake control actuating force	± 1
Slope	± 1
Brake retarding force	± 1

5.4 Brake retarding force

A means (normally another machine) to generate the towing or pulling force required by the performance tests in 6.1.1, 6.1.2 and 6.2.1 shall be provided.

6 Test and performance criteria for brake systems

6.1 Towing test for service and secondary brakes

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

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

6.1.1 Service brake performance criteria

Application of the service brake system with the force specified in table 1 shall cause the moving test machine to develop a brake retarding force as specified in table 3 in both the forward and reverse directions.

Table 3 — Performance criteria for brake systems

Brake system	Brake retarding force N
Service	$9{,}8m \sin \alpha$ (dynamic)
Secondary	$4{,}9m \sin \alpha$ (dynamic)
Parking	$9{,}8m \sin \alpha$ (static)
m is the machine mass in kilograms (see 3.5) α is the slope capability in degrees (see 3.6)	

6.1.2 Secondary brake performance criteria

Since tracked machines have two independent brakes of nominally equal capacity, application of the secondary brake system with the force specified in table 1 shall cause at least one track on the moving test machine to develop a brake retarding force equal to the value specified in table 3, in both the forward and reverse directions.

6.2 Static pull test for parking brake

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

6.2.1 Parking brake performance criteria

Application of the parking brake system with the force specified in table 1 shall hold the test machine's tracks stopped and develop a static pulling force as specified in table 3 in both the forward and reverse directions.

6.2.2 Criteria for brakes remaining applied

After application, the parking brake system shall maintain the parking brake performance specified in table 3 regardless of any contraction of the brake parts or leakage of any kind. This system shall not be dependent upon an exhaustible energy source.

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