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Machinery for forestry — Self-propelled machinery — Safety requirements

Matériel forestier — Machines automotrices — Prescriptions de sécurité

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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 11850 was prepared by Technical Committee ISO/TC 23, *Tractors and machinery for agriculture and forestry*, Subcommittee SC 15, *Machinery for forestry*.

This second edition cancels and replaces the first edition (ISO 11850:1996), which has been technically revised.

Machinery for forestry — Self-propelled machinery — Safety requirements

1 Scope

This International Standard specifies safety requirements for common design aspects of mobile, ride-on, self-propelled forestry machines. It is applicable to fellers, bunchers, delimiters, forwarders, log loaders, skidders, processors, harvesters, and multi-function versions of these machine types, as defined in ISO 6814. It is not applicable to the optional attachments for these machines. It covers certain hazards common to forestry machinery, but does not, as a standard that addresses common requirements, deal with all the hazards (noise, vibration, thrown objects, etc.) which could exist on a particular machine. Its use will therefore not alone be sufficient to cover all significant risks for a majority of machines.

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 2860, *Earth-moving machinery — Minimum access dimensions*

ISO 2867:1994, *Earth-moving machinery — Access systems*

ISO 3411:1995, *Earth-moving machinery — Human physical dimensions of operators and minimum operator space envelope*

ISO 3450, *Earth-moving machinery — Braking systems of rubber-tyred machines — Systems and performance requirements and test procedures*

ISO 3457, *Earth-moving machinery — Guards and shields — Definitions and specifications*

ISO 3471, *Earth-moving machinery — Roll-over protective structures — Laboratory tests and performance requirements*

ISO 3600, *Tractors, machinery for agriculture and forestry, powered lawn and garden equipment — Operator's manuals — Content and presentation*

ISO 3767-1, *Tractors, machinery for agriculture and forestry, powered lawn and garden equipment — Symbols for operator controls and other displays — Part 1: Common symbols*

ISO 3767-4, *Tractors, machinery for agriculture and forestry, powered lawn and garden equipment — Symbols for operator controls and other displays — Part 4: Symbols for forestry machinery*

ISO 3795, *Road vehicles, and tractors and machinery for agriculture and forestry — Determination of burning behaviour of interior material*

ISO 4254-4, *Tractors and machinery for agriculture and forestry — Technical means for ensuring safety — Part 4: Forestry winches*

ISO 5010:1992, *Earth-moving machinery — Rubber-tyred machines — Steering requirements*

ISO 6405-1, *Earth-moving machinery — Symbols for operator controls and other displays — Part 1: Common symbols*

ISO 6682, *Earth-moving machinery — Zones of comfort and reach for controls*

ISO 6683, *Earth-moving machinery — Seat belts and seat belt anchorages*

ISO 6750, *Earth-moving machinery — Operation and maintenance — Format and content of manuals*

ISO 6814, *Machinery for forestry — Mobile and self-propelled machinery — Terms, definitions and classification*

ISO 8082, *Self-propelled machinery for forestry — Roll-over protective structures — Laboratory tests and performance requirements*

ISO 8083, *Machinery for forestry — Falling-object protective structures — Laboratory tests and performance requirements*

ISO 8084, *Machinery for forestry — Operator protective structures — Laboratory tests and performance requirements*

ISO 9244, *Earth-moving machinery — Safety signs and hazard pictorials — General principles*

ISO 9533, *Earth-moving machinery — Machine-mounted forward and reverse audible warning alarm — Sound test method*

ISO 10263-2, *Earth-moving machinery — Operator enclosure environment — Part 2: Air filter test*

ISO 10263-5:1994, *Earth-moving machinery — Operator enclosure environment — Part 5: Windscreen defrosting system test method*

ISO 10532, *Earth-moving machinery — Machine mounted retrieval device — Performance requirements*

ISO 10533, *Earth-moving machinery — Lift-arm support devices*

ISO 10570, *Earth-moving machinery — Articulated frame lock — Performance requirements*

ISO 11112, *Earth-moving machinery — Operator's seat — Dimensions and requirements*

ISO 11169, *Machinery for forestry — Wheeled special machines — Vocabulary, performance test methods and criteria for brake systems*

ISO 11512, *Machinery for forestry — Tracked special machines — Performance criteria for brake systems*

ISO 11684, *Tractors and machinery for agriculture and forestry, powered lawn and garden equipment — Safety signs and hazard pictorials — General principles*

ISO 13766, *Earth-moving machinery — Electromagnetic compatibility*

ISO 13852:1996, *Safety of machinery — Safety distances to prevent danger zones being reached by the upper limbs*

ISO 14269-4, *Tractors and self-propelled machines for agriculture and forestry — Operator enclosure environment — Part 4: Air filter element test method*

ISO 14982, *Agricultural and forestry machinery — Electromagnetic compatibility — Test methods and acceptance criteria*

ISO 15078, *Machinery for forestry — Log loaders — Location and method of operation of two-lever operator controls*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 6814 apply.

4 Safety requirements

4.1 Safety distances, guards and shields

Safety distances shall comply with the requirements of Tables 1, 3, 4 and 6 of ISO 13852:1996. Guards and shields shall be in accordance with ISO 3457 and ISO 13852. Thermal guards shall meet the requirements of ISO 3457.

4.2 Operator station

4.2.1 Operator space envelope

The design and arrangement shall allow the operator to perform all normal operations at each operating position without equipment or working attachments infringing on the operator space envelope as defined in ISO 3411:1995, Clause 5, or the space required for operation of controls (see 4.7).

4.2.2 Structures for operator protection

4.2.2.1 Falling object protective structure (FOPS)

All machines shall be equipped with a FOPS in accordance with ISO 8083.

4.2.2.2 Roll-over protective structure (ROPS)

All applicable machines according to the scope of ISO 8082 shall be equipped with a ROPS or other type of operator protection in accordance with ISO 8082 or ISO 3471.

NOTE Research work is being done to develop a test method and acceptance criteria for machines with a rotating platform with a cab and boom on the platform. These machines are to be included in a future revision of ISO 8082.

4.2.2.3 Operator protective structure (OPS)

All applicable machines according to the scope of ISO 8084 shall have an OPS in accordance with ISO 8084.

A device or devices intended to deflect saplings and branches shall be installed on skidders ahead of or behind the operator's station, as appropriate.

The operator shall be protected from hazards caused by failed chains, teeth and similar failures using polycarbonate or equivalent glazing, or other appropriate guards or shields, or both.

NOTE Criteria are to be developed.

All machines equipped with winches or subject to breaking lines shall be equipped with protective screens or glazing or both, between the operator and the winch and in accordance with ISO 8084.

4.2.2.4 Seat belt

All machines shall be equipped with a seat belt system in accordance with ISO 6683. Seat belts shall have a device to keep them off the floor when not in use. A pictorial representation reminding operators that the seat belt must be used shall be displayed.

Seat belts shall bear a permanent and legibly marked label containing the following information:

- statement of compliance with ISO 6683;
- year of manufacture;
- belt model number;
- name of manufacturer or importer/distributor.

4.2.2.5 Load bunk headboard

The load bunk of all tree and log transporting machines shall be equipped with a headboard capable of withstanding a force of 35 000 N applied at any point perpendicular to the face of the structure. The test object used, a steel interlayer of diameter 200 mm, or of 200 mm × 200 mm, with edges rounded to R 13, shall be placed on as few bars as possible. Permanent deformation shall be maximum of 100 mm. A 100 mm diameter log (or object) shall not pass through the load bunk headboard.

The headboard shall be located between the load and the operator's station, and its height, in the transport position shall be greater than or equal to the height of the operator station. The headboard width shall be no less than the width across the stakes.

4.2.2.6 Fumes, spillage, hose guards and sharp edges

A person in the operator station shall be protected as follows.

- a) Engine exhaust and harmful gases from heating systems shall be directed away from the operator's station, including any of its air intakes.
- b) Fuel and other fluid fillers shall be located outside the operator's station. The design, sealing and location of these fillers shall be chosen to minimize the potential for spillage into the operator's station. Tanks shall have means for safely relieving internal pressure before opening or when being opened.
- c) The battery location or locations shall be within easy access and shall minimize the potential of fumes and acid entering the operator's station, even in the event of the machine overturning. Batteries shall have provisions for easy handling.
- d) Pressurized hoses, pipes and components shall be located or shielded so that in the event of rupture the fluid cannot be discharged directly onto the operator when in the operating position. Movable shields (e.g. doors or windows) designed to be open during machine operations shall satisfy this requirement in all operating positions.
- e) Structural edges and corners of metallic or non-metallic materials of hardness sufficient to cause contusions or penetration of the human skin shall meet the following requirements:
 - 1) external corners such as on-cab or service doors and pointed objects shall have a minimum radius of 4 mm;
 - 2) grab-handles and edges/corners of handholds shall have a minimum radius of 5 mm.

4.2.3 Seat

Machines shall be fitted with a seat in accordance with ISO 11112 which positions the operator for ergonomic and stable operation of the machine controls.

A minimum 25 mm clearance between the seat and fixed objects that could cause pinching shall be maintained when adjusting the seat in the driving or working position or when rotating the seat between those positions. Adjusting the seat fore or aft, or both, shall be permissible while rotating it from the driving or working position.

The seat shall be adjustable without the use of tools.

4.2.4 Operator environment

If a closed cab is provided, it shall be equipped with a pressurization system that provides a positive pressure and with a filtration system that removes at least 98 % by mass of dust when measured in accordance with ISO 10263-2 or ISO 14269-4.

4.3 Access to operator's station and maintenance locations

Access to the operator's station and maintenance locations for daily service shall be as follows.

- a) The access shall permit a person to achieve three points of support if the platform or work surface is elevated by more than 550 mm above the ground, and shall be in accordance with ISO 2860 and ISO 2867. Foot placement surfaces shall be slip-resistant and the design of the steps shall be such that accumulation of debris, mud, snow, etc. is minimized.
 - 1) On tracked machines, an access step on the track frame may be inset up to 100 mm from the edge of the track shoe.
 - 2) On machines with articulated steering, a minimum clearance of 150 mm shall be available, at the fully articulated steering position, as shown in Figure 1.
- b) The access system shall minimize the possibility of controls being used as handholds.
- c) The operator's station entry/exit opening dimensions shall be in accordance with ISO 2867. On cab- or partial-enclosure-equipped machines a minimum of two openings on different surfaces shall be provided: a primary opening for the main access way and a secondary opening to serve as an emergency exit. The primary opening shall be in accordance with ISO 2867:1994, Figure 4 and Table 4, and the secondary opening with ISO 2867:1994, Table 4. If the two required openings are enclosed by doors, windows or screens, they shall be able to be opened from both the inside and outside without tools. Locks may be used on these openings provided they can be unlocked or opened from the inside. A prominent sign shall be posted at the alternative opening reminding the operator to unlock it before operating the machine.
- d) Hinged doors and windows of the operator's station shall have a device for retaining them in the open and shut positions. The required operator protection, OPS, shall be maintained if the doors or windows are designed to remain open during machine operation. When use of the OPS requires that doors and windows be closed, a decal shall be used alerting the operator to this effect.
- e) Service and maintenance openings for daily service shall be in accordance with ISO 2867:1994, Table 4. If the size or weight of hinged doors, lids or hoods creates a hazard, a device shall be provided for holding them open.
- f) Machines with articulated frames shall be equipped with articulated frame locks in accordance with ISO 10570.

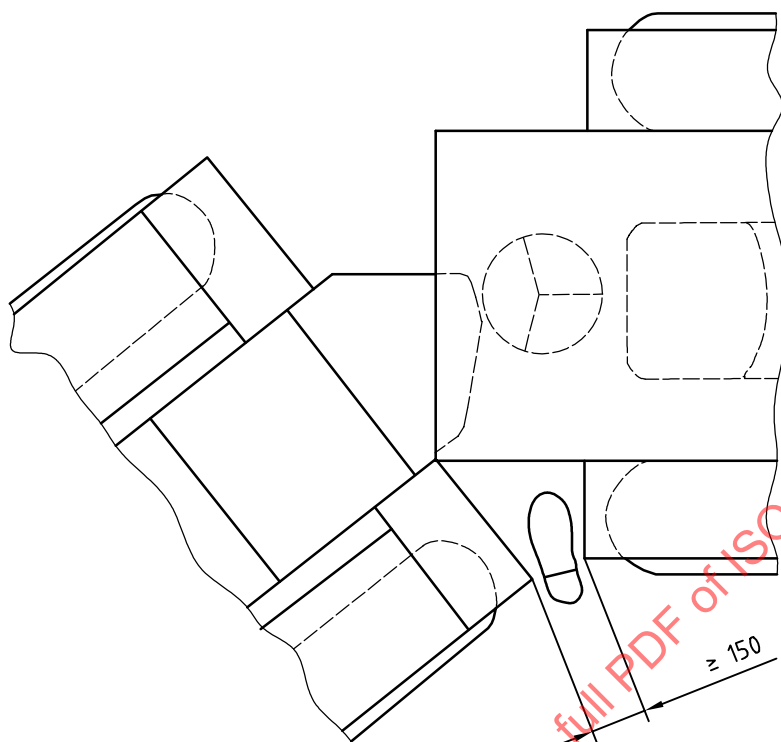


Figure 1 — Minimum clearance on machines with articulated steering

4.4 Visibility

Provision shall be made for good visibility to the operating and driving directions, and a means of cleaning the windscreen, for example, by use of windshield wipers and washers, shall be provided. If wipers are used on polycarbonate glazing, the glazing surface shall be hard-coated.

The windscreen defrosting system, when provided, shall be tested in accordance with ISO 10263-5:1994; those windscreen areas to be defrosted shall be in accordance with Table 1 in respect of excavators. The minimum percentage of defrosted area after 1 h shall be in accordance with ISO 10263-5:1994, Table 2.

Glare from sunshine or artificial lighting shall be minimized by shielding or by location.

Rainwater draining from the roof shall be directed away from windows.

4.5 Warning alarm

Machines shall be equipped with an operator-controlled alarm horn in accordance with the forward alarm requirements of ISO 9533.

4.6 Lighting

4.6.1 Working lights

The machine shall have provisions for optional working lights. The electrical system shall have a capacity adequate for the maximum intended provisions.

4.6.2 Instrument and monitor lights

Instrument and monitor lighting shall be provided to permit machine operation in the dark. The arrangement or design of the instrument panel and monitor lights shall be such that glare and reflection for the operator are minimized.

4.6.3 Operator station and maintenance lighting

An interior light shall be installed on machines equipped with enclosed cabs.

When internal parts require inspection, adjustment or maintenance, an electrical outlet shall be provided to allow the connection of a portable lamp.

4.7 Controls

4.7.1 Engine stop control

The engine stop control shall be clearly identified and, if separate from the ignition key, shall be red in colour and remain in the stop position when placed there.

4.7.2 Other controls

The operator controls shall be selected, designed, constructed and arranged as follows.

- a) Primary controls shall be located within the zones of comfort and secondary controls within the zones of reach in accordance with ISO 6682. Control arrangement and function shall consider space requirements for arctic clothing in accordance with ISO 2860 and ISO 3411, unless a heated operator enclosure is provided.
- b) Control functions shall be clearly and permanently identified unless obvious (e.g. a steering wheel or brake pedal). Symbols in accordance with ISO 3767-1 or ISO 6405-1:1991, in addition to ISO 3767-4, shall be used. Words may be used to complement such symbols or in cases where appropriate symbols have not been standardized. All symbols shall be explained in the instruction handbook.
- c) Log loader controls shall be in accordance with ISO 15078.
- d) Control movement and sequence shall be explained in the instruction handbook. The required travel and actuation force of controls shall be consistent with the frequency of use and practical ergonomics needed to minimize operator fatigue or stress.
- e) Foot pedals shall be of appropriate size, shape, spacing and slip-resistant surface. In designs where there is an analogy between driving a forestry machine and a motor vehicle (i.e. with the clutch on the left, the brake in the centre and the accelerator on the right), pedals shall be similarly located to avoid the risk of confusion.
- f) Equipment controls shall automatically return to their neutral position when the operator releases the control. This does not apply to travel or other controls where a detent is required for a specific operational requirement.
- g) Controls which cause movement of the machine or equipment shall be arranged, protected or provided with neutral-position locks to minimize accidental activation when the operator enters or leaves the machine.
- h) For machines with more than one working position, the operator shall be able to move from one position to the other without hazard from accidental contact with a control.

4.8 Starting

4.8.1 Transmission neutral start

In order to prevent unexpected machine movement during engine start-up, an interlock shall be provided which shall prevent the engine from being started unless

- the transmission is in neutral, or
- the transmission clutch is disengaged, or
- the combination direction and speed control is in neutral, or
- an equivalent system is provided.

No interlock is required if the transmission control returns to neutral when released.

4.8.2 Bypass start protection

Starter-motor solenoid and relay electrical connections shall be shielded to prevent accidental connection and to discourage deliberate connection that circumvents neutral start interlock features without using tools.

4.8.3 Unauthorized starting or movement of machines

The starting of a machine shall require deliberate activation of a control.

Means shall be provided to render the starting control and parking release systems inoperative in order to deter unauthorized machine or working tool movement following machine shutdown. Locking devices such as key-type ignition switches, lockable master disconnect switches or provisions for padlocks, satisfy this requirement. Lockable cabs may be used as protection for controls or systems located within the cab.

4.9 Braking systems

The braking systems of wheeled machines shall be in accordance with ISO 11169, while those of tracked machines shall be in accordance with ISO 11512. The braking systems of those wheeled machines not included within the scope of ISO 11169 shall be in accordance with ISO 3450.

4.10 Steering systems

The steering of wheeled machines shall be in accordance with ISO 5010. In addition, wheeled machines with a maximum travel speed of > 30 km/h shall be provided with emergency steering in accordance with ISO 5010.

4.11 Winches

Winches used in forestry applications shall have line attached to drum using a breakaway device or such that the line will clear the drum if the operator so desires; the requirements of ISO 4254-4 shall be met. See 4.2.2.3.

4.12 Retrieval, tie-down and machine-lifting devices

Both front and rear of the machine shall be equipped with a retrieval device or devices in accordance with ISO 10532.

The machine shall be equipped with tie-down points for transporting machines on trucks, trailers, etc. These points shall be clearly identified on the machine.