
**Tractors and self-propelled machinery
for agriculture — Operator controls
— Actuating forces, displacement,
location and method of operation**

*Tracteurs et machines agricoles automotrices — Commandes de
l'opérateur — Forces de manoeuvre, déplacements, emplacements et
modes de fonctionnement*

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Published in Switzerland

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 23, *Tractors and machinery for agriculture and forestry*, Subcommittee SC 3, *Safety and comfort*.

This second edition cancels and replaces the first edition (ISO 15077:2008), which has been technically revised.

The main changes compared to the previous edition are as follows.

- In [Clause 3](#):
 - the definition for hybrid power source has been added;
 - the definition for critical VT operator control has been revised.
- In [Clause 4](#):
 - multiple new general requirements have been added;
 - a new subclause (4.2) specifically for identification has been added;
 - additional requirements for stopping and starting has been added in [Table 1](#);
 - provisions for new technologies have been introduced into [Table 1](#);
 - requirements for speed selection pattern in [Table 1](#) related to manual/nonlinear transmission shifting patterns have been clarified;
 - new requirements for remote engine starting have been added in [Table 1](#).
- In [Annex A](#):
 - the annex has been reorganized for clarity and flow;
 - torque values have been added to [Table A.1](#) for rotational controls;

- a new [Figure A.1](#) has been added for clarity;
- [Figure A.2](#) (former Figure A.1) has been revised to correct the operator's position.
- In [Annex B](#):
 - reference to AEF 006 has been added.
- In [Annex C](#):
 - colour identification numbers have been added to [Table C.1](#).

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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Introduction

This document has been developed to provide guidance on methods of operation and requirements for operator controls. These provisions were derived from experience, current practice, human factors literature and existing standards. Specific operating requirements are given for controls common to many tractors and self-propelled agricultural machinery.

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Tractors and self-propelled machinery for agriculture — Operator controls — Actuating forces, displacement, location and method of operation

1 Scope

This document specifies methods of operation and requirements related to manual (for example, hand-, finger-, foot-operated) controls as well as controls associated with virtual terminals intended for a seated operator.

It applies to controls installed on agricultural tractors and self-propelled agricultural machinery.

It also gives recommendations for the control actuating forces and torques, direction of motion and location of these manual controls.

This document also specifies the minimum information relevant to manual controls to be provided in the operator's manual, for use as intended by the manufacturer.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 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 3767-2, *Tractors, machinery for agriculture and forestry, powered lawn and garden equipment — Symbols for operator controls and other displays — Part 2: Symbols for agricultural tractors and machinery*

ISO 11783-6, *Tractors and machinery for agriculture and forestry — Serial control and communications data network — Part 6: Virtual terminal*

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

3.1

control

device actuated by an operator to effect a response from the machine, its attachments or its implements

3.2

control actuating force

force exerted at the centre of the control contact surface and in the direction of its movement to effect a control function

3.3

forward

direction the operator faces while seated in the operator's seat with the machine and the operator's seat in the position for forward travel as defined by the manufacturer

3.4

decelerator pedal

control used on certain machines which, when actuated, reduces the engine speed

3.5

hand-operated control

device manipulated by the operator's hand

3.5.1

hand-operated control with finger/wrist activation

hand control manipulated by the movement of one or more fingers or the wrist, with little or no shoulder/elbow motion

3.5.2

hand-operated control with arm activation

hand control gripped by the hand and moved primarily by shoulder/elbow movement

3.6

auxiliary input unit

electronic control unit (ECU) containing one or more *virtual terminal (VT) operator controls* (3.9) for common use and facilitating the machine operation

Note 1 to entry: See ISO 11783-6.

3.7

non-critical function

machine function which, when actuated, presents a minimal risk to the machine operator or bystanders

3.8

critical function

machine function which, when actuated, can cause an action that could be hazardous to the machine operator or bystanders

3.9

virtual terminal operator control

VT operator control

element of an *auxiliary input unit* (3.6) or of a remote key pad, or virtual terminal soft key or touch screen control or reconfigurable proprietary control meeting the requirements of ISO 11783-6 and those specified in [Annex B](#)

3.9.1

non-critical VT operator control

VT operator control (3.9) that is suitable only for the control of *non-critical functions* (3.7)

3.9.2

critical VT operator control

VT operator control (3.9) input suitable for the control of *critical functions* (3.8) with a means of preventing inadvertent operation

3.10

pointing unit control

means of activating and releasing of a function displayed by *virtual terminal operator control* (3.9)

3.11

foot-operated control

device manipulated by the operator's foot

3.12**hybrid power source**

use of two or more distinct types of power, such as an internal combustion engine to drive an electric generator that powers an electric traction drive motor

4 Requirements**4.1 General**

4.1.1 Controls shall be arranged so that their layout, travel and resistance to operation are compatible with the action to be performed, taking account of ergonomic principles.

4.1.2 The unintentional actuation of controls shall be avoided, for example, by suitable design or position.

4.1.3 The incorrect actuation of controls shall be avoided, for example, by suitable design, arrangement, marking or lighting.

4.2 Identification

4.2.1 Control functions and movements shall be identified by symbols conforming to ISO 3767-1 or ISO 3767-2 so that the operator can determine the proper control function and movement. In cases where the ISO 3767 series of standards do not include a suitable symbol that addresses a machine's function (for example, as a result of new technology), it is acceptable for the manufacturer to develop and use an appropriate symbol. The explanation of all symbols shall be included in the operator manual. Identification is not required for controls that have universal recognition by virtue of their shape, colour, location, arrangements or method of actuation, such as a steering wheel, foot-operated clutch pedal, service brake or accelerator pedal.

NOTE The symbols given in the ISO 3767 series are also registered in ISO 7000.

4.2.2 When a control device is designed and constructed to perform several different actions, the actions shall be clearly identified or displayed and subject to confirmation, when necessary.

4.2.3 For identification of manual controls by colour coding, see [Annex C](#).

4.3 Foot-operated controls

Foot-operated controls shall be designed to minimize the risk of the foot slipping off the pedal.

4.4 Control actuating forces and torques, direction of motion, and location

Guidelines for control actuating forces and torques, and generic direction of motion for controls are given in [Annex A](#). Minimum control actuating forces shall be sufficient to avoid inadvertent actuation by the force of a hand or foot resting on the control during anticipated operating conditions.

NOTE ISO 5697 and ISO 10998 specify maximum actuating forces not to be exceeded to meet the braking and steering performance requirements. Actuating forces to be applied for normal operation referred to in this document are usually lower.

4.5 Control operation

Control operations shall be in accordance with [Table 1](#) if provided on the machine.

NOTE The control motion indicated in [Table 1](#) represents the motion of several control types such as levers, rocker switches, pairs of push buttons, or sliders. For example, if a pair of buttons or a rocker switch are used to raise and lower the three-point hitch, the interpretation of [Table 1](#), No. 8.1, would be to use the button in the upper or rearward position to raise the hitch and the button in the lower or forward position to lower the hitch.

Table 1 — Control operation

No.	Control	Control operation and requirements
1	Engine	
1.1	Starting/stopping engine	Provisions shall be made to prevent the engine start unless: <ul style="list-style-type: none"> a) in case of self-propelled machinery designed for a ride-on operator only, the driver is in the driver station; b) the traction transmissions are in neutral or parked position or the traction clutch is disengaged; c) the master implement clutch and, if separate, the power take-off (PTO) clutch are disengaged; d) hybrid power sources are excluded from the above requirements.
1.1.1	Starting engine (rotational switch)	The control shall be rotated clockwise to operate engine starter.
1.1.2	Engine preheater circuit (rotational switch)	If an engine preheater circuit is provided, this control shall occur before or at the starting position. It may be activated by rotating the control clockwise, anticlockwise (counter-clockwise) or pushing inwards on the control.
1.1.3	Stopping engine (rotational switch)	The control shall be rotated anticlockwise (counter-clockwise) to the stop position.
1.1.4	Stopping engine (mechanical control)	When the stop control is actuated, controls shall automatically remain in the stop position without the application of sustained manual effort. Direction of motion shall be pulled to stop. The control shall be located within 150 mm of the engine start control. If the stop control is combined with the speed control, it shall be in the direction of and beyond the low idle position.
1.1.5	Starting/stopping engine (finger operated push button switch)	The button shall be actuated to start or stop the engine.
1.1.6	Remote engine starting	Provision shall be made to prevent remote engine starting unless: <ul style="list-style-type: none"> a) the traction transmissions are in the neutral or parked position or the traction clutch is disengaged; b) the master implement clutch and, if separate, the PTO clutch are disengaged; c) hazards associated with engine motion are mitigated.
1.2	Engine speed	
1.2.1	Foot-operated	The control shall be readily accessible to the operator's right foot. The pedal shall be pushed forward, downward, or both forward and downward to increase engine speed.

Table 1 (continued)

No.	Control	Control operation and requirements
1.2.2	Hand-operated variable speed	The control shall be positioned in front of, or to the right of, the operator. Direction of motion shall be in a plane generally parallel to the longitudinal axis of the vehicle. The control shall be moved away from the operator (generally forward) to increase engine speed.
1.2.3	Hand-operated discrete settings	The control shall be positioned in front of, or to the right of, the operator. The actuation of the part of the control which is generally away from the operator shall select higher speed settings.
1.2.4	Decelerator pedal	If provided, the control shall be positioned in front of, or to the right of, the operator and be readily accessible to the operator's right foot. The direction of motion shall be forward, downward, or both forward and downward to decrease engine speed. A foot-operated engine speed control as described in 1.2.1 shall not be provided.
2	Steering (when travelling in a forward direction)	
2.1	Steering wheel	When a steering wheel control is provided, a clockwise rotation shall effect a right turn, and an anticlockwise (counter-clockwise) rotation shall effect a left turn.
2.2	Two levers	When two levers are provided for steering: — a right turn shall be effected by moving the right-hand lever rearward, the left-hand lever forward, or both; — a left turn shall be effected by moving the left-hand lever rearward, the right-hand lever forward, or both.
2.3	One lever	When one lever is provided for steering, a lateral motion of the lever to the right shall effect a right turn and a lateral motion to the left shall effect a left turn.
3	Brakes	
3.1	Service brake	
3.1.1	Foot-operated	Pedals shall be readily accessible to the operator's right foot, except as noted in Table 1, No. 3.1.2. The direction of motion for engagement shall be forward, downward, or both. Where separate brake pedals are provided for the independent righthand and left-hand brake control, it shall be possible to obtain combined control with one foot.
3.1.2	Foot operated brake used in combination with Table 1, No. 4.2.1 and Table 1, No. 4.2.2	Pedal(s) may be installed to be activated by the left-hand foot in case that a sustained activation of the right-hand pedal(s) is required to keep the vehicle in motion (for example, with hydrostat transmission with one pedal for forward and one for reverse (Table 1, No. 4.2.2) or a toe and heel pedal for respectively forward and reverse motion (Table 1, No. 4.2.1).
3.2	Park brake	
3.2.1	Hand-operated with finger/wrist activation (for example, electrical switch, button)	The park brake shall remain applied without manual effort. Provision shall be made to prevent unintentional release.
3.2.2	Hand-operated with arm activation	The control shall be pulled to apply the brake. A device shall be provided to retain the brake control in the applied position. Provision shall be made to prevent unintentional release.
3.2.3	Foot-operated	The direction of motion shall be forward, downward, or both for engagement. A device shall be provided to retain the brake control in the applied position. Provision shall be made to prevent unintentional release.