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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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Foreword

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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.

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.

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: 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: 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.

Table 1 *(continued)*

No.	Control	Control operation and requirements
3.2.4	Combined control for parking and transmission	Provision shall be made to prevent unintentional disengagement.
3.3	**Secondary braking system**	
3.3.1	Hand-operated with finger/ wrist activation (for example, electrical switch)	The control shall be actuated as instructed by the manufacturer. The actuation can include being moved forward or moved away.
3.3.2	Hand-operated with arm activation	The control shall be pulled to apply the brake.
3.3.3	Foot-operated	The direction of motion shall be forward, downward, or both to apply the brake.
4	**Transmission**	
4.1	**Clutch** (includes combined transmission and PTO) See also PTO control, Section 7.	
4.1.1	Foot-operated	The control shall be readily accessible to operator's left foot. The pedal shall be pushed forward, downward, or both for disengagement.
4.1.2	Hand-operated with arm activation	The control shall be moved rearward or towards the operator for disengagement. Positive means shall be provided for holding the clutch control in the disengaged position so that it is incapable of being reengaged unless manually operated. It is recommended that the clutch be operable only from the operator's seat.
4.2	**Combination ground speed and forward/reverse direction** (continuously variable combined control)	Provision shall be made to prevent unintentional movement of the control from a) neutral to forward or reverse, b) forward to reverse, c) reverse to forward, or, alternatively: the machine motion due to unintentional movement of this control shall be prevented. The neutral position shall be clearly identified and easy to select.
4.2.1	Foot-operated — one pedal, or two pedals longitudinally related to simulate one pedal	The control shall be readily accessible to the operator's right foot. Forward motion and increasing forward speed shall be caused by moving the front of the pedal forward, downward, or both. Rearward motion and increasing rearward speed shall be caused by moving the rear of the pedal downward. The requirement of 3.1.1 does not apply in this case.
4.2.2	Foot-operated — two pedals (side by side)	The control shall be readily accessible to the operator's right foot. Rearward motion and increasing rearward speed shall be caused by moving the outer pedal forward, downward, or both. Forward motion and increasing forward speed shall be caused by moving the inner pedal forward, downward, or both. The requirement of 3.1.1 does not apply in this case.
4.2.3	Hand-operated	Forward motion and increasing forward speed shall be caused by moving the control from the neutral position forward, upward, or both. Rearward motion and increasing rearward speed shall be caused by moving the control from the neutral position rearward, downward, or both.

Table 1 *(continued)*

No.	Control	Control operation and requirements
4.3	**Speed selection**	
4.3.1	Hand operated	Speed selection pattern shall be clearly marked.
4.3.2	Foot-operated	The control shall be pushed forward or down for higher speed.
4.3.3	Finger operated memory setting (for example, push button)	A push button control shall be pressed to select a set speed.
4.4	**Direction control** (forward-reverse non-variable speed)	Provision shall be made to prevent unintentional movement of the control from a) neutral to forward or reverse, b) forward to reverse, c) reverse to forward, or, alternatively: the machine motion due to unintentional movement of this control shall be prevented. The neutral position shall be clearly identified and easy to select.
4.4.1	Hand or finger operated	The control shall be moved forward, upward, or both to effect forward motion. The control shall be moved rearward, downward, or both to effect rearward motion.
4.4.2	Forward-Reverse momentary switch	Finger operated push button - The push button shall be pressed momentarily to change the current direction. Neutral position shall be obtained by other transmission controls.
5	**Master implement control, header or gathering unit clutch**	
5.1	Hand-operated	The control shall be moved rearward or downward for disengagement. Provision shall be made to prevent unintentional engagement of the clutch. The control shall be operable only from the operator's seat.
5.2	Finger-operated	Finger operated push button - The push button shall be pressed momentarily to engage and disengage. Provision shall be made to prevent unintentional engagement.
6	**Differential lock**	
6.1	Foot or hand-operated	The control shall be moved forward or downward for engagement. If the differential lock remains on after release of the actuation mechanism, a means to indicate the differential lock engagement status to the operator shall be provided.
6.2	Finger-operated	Finger operated push button — The push button shall be pressed momentarily to engage and disengage differential lock. Provision shall be made to prevent unintentional engagement of the differential lock or to limit the speed when the differential lock can be engaged while turning.
7	**PTO (power take-off)**	
7.1	**Clutch**	
7.1.1	Foot-operated	The control shall be readily accessible to the operator's left foot. The pedal shall be pushed forward, downward, or both for disengagement. In the case of a combined traction-drive/PTO clutch, the PTO disengagement shall be the second stage.

Table 1 *(continued)*

No.	Control	Control operation and requirements
7.1.2	Hand-operated	The control shall be moved upward, forward, or both to engage. The control shall be moved downward or rearward to disengage. Provision shall be made to prevent unintentional engagement of the PTO clutch.
7.1.3	Finger-operated	Finger operated push button — The push button shall be pressed momentarily to engage and disengage PTO clutch. Provision shall be made to prevent unintentional engagement of the PTO clutch.
8	**Implements and auxiliaries**	
8.1	**Lift mechanism (three-point hitch)**	
8.1.1	Hand-operated	The control shall be readily accessible to the operator's right hand and moved upward, rearward or both to raise and downward, forward or both to lower. It shall be possible to lock the control levers or mechanism in the upper position.
8.2	**Front loader**	
8.2.1	Two levers — lift arm, bucket/ attachment	The bucket/attachment control shall be located to the right of the lift arm control. The direction of control motion shall be forward, downward, or away from the operator to lower the lift arm, and in opposite directions to raise the lift arm. The direction of control motion shall be forward, downward, or away from the operator to dump the bucket/attachment, and in opposite directions to roll back the bucket/attachment.
8.2.2	One lever — lift arm, bucket/ attachment	The direction of control motion shall be forward, downward, or away from the operator to lower the lift arm, and in opposite directions to raise the lift arm. Movement of the control away from the operator shall dump the bucket/attachment and movement of the control toward the operator shall roll back the bucket/attachment.
8.3	**Selective hydraulic function**	The direction of control motion for a remote hydraulic function shall be forward, downward, or away from the operator to lower or move forward the function; and rearward, upward, or toward the operator to raise or move rearward the function. Additional selective hydraulic functions shall be defined in the corresponding implement's operator's manual.
9	**VT Operator controls**	VT operator controls shall comply with the requirements of Annex B.

Annex A
(informative)

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

A.1 Control actuating forces and torques

A.1.1 The control actuating forces and torques given in Table A.1 should not be exceeded for normal operation. However, emergency situations may require higher forces.

Table A.1 — Control actuating forces and torques

Type of control	Normal force (frequent operation) (N)	Maximum force (N)
Lever (fore/aft)	80	230
Lever (lateral)	60	100
Lever (vertical upwards)	60	400
Pedal (leg/foot operation)	120[a]	450
Pedal (ankle rotation)	50	90
Finger/wrist operation (push/pull/press)	10	20
Type of control	**Torque (maximum)** (N mm)	
Finger operation (rotational)	42	
Wrist operation (rotational)	680	

NOTE These forces do not apply to steering and braking systems. Maximum input forces for these systems are specified in ISO 10998 and ISO 5697. See also the NOTE to 4.4.

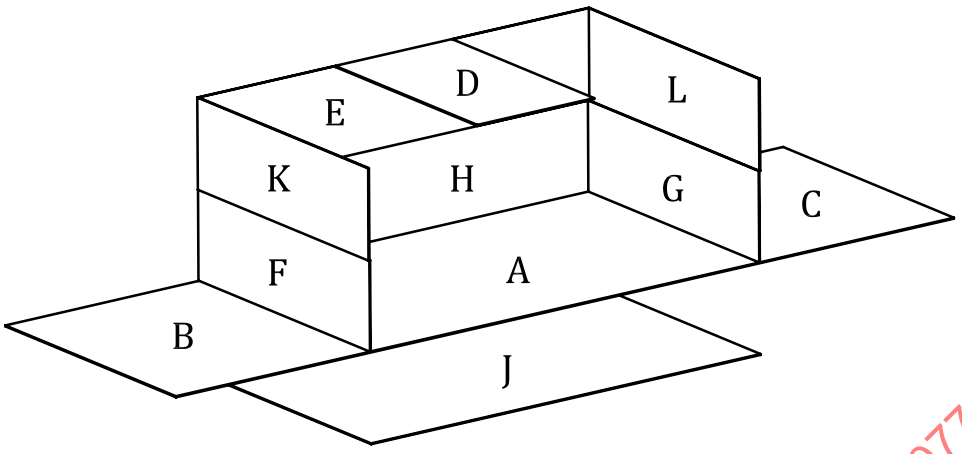
[a] With back support, 150 N.

A.1.2 Minimum control forces are dependent on the control system and are not stated.

A.2 Control arrangement

A.2.1 Panels

For the purposes of this document, panels are shown in Figure A.1.



Key

panel A	horizontal transverse centre	panel G	vertical transverse right
panel B	horizontal transverse left	panel H	vertical transverse front
panel C	horizontal transverse right	panel J	horizontal lower centre
panel D	horizontal top centre	panel K	vertical upper left
panel E	vertical upper front	panel L	vertical upper right
panel F	vertical transverse left		

NOTE Panels H, C, B and J constitute the prime work areas.

Figure A.1 — Panels

A.2.2 Panels orientation allowance

A.2.2.1 The recommended maximum angles for panels are given in Figure A.2.

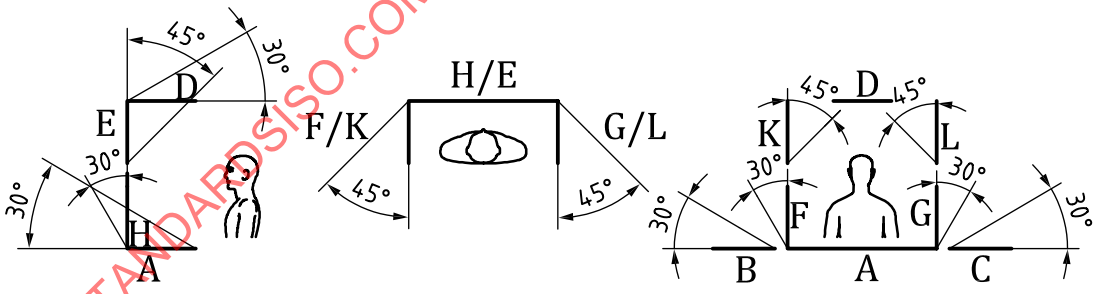


Figure A.2 — Recommended maximum angles for panels

A.2.2.2 Overhead panel D should be horizontal or up to 30° above horizontal.

A.2.2.3 High panel E should be angled 45° or less from vertical.

A.2.2.4 Vertical panels F and G should be angled less than 30°.

A.2.2.5 Horizontal control panels A, B, and C may be tilted up to 30°.

A.2.3 Control location/layout

A.2.3.1 If controls are designed with operator rotation in mind, panels B and C should be identical to panel A.

A.2.3.2 If the operator can turn to face side panels F and G, all controls should be similar to H.

A.2.3.3 It is recommended that a control should not be located on a surface which causes ambiguity in the relationship between control movement and function movement.

For example, a lever control for a raise-lower function should not be located on a 30° to 60° upward sloping surface, since the recommended direction of the motion changes when it is moved from a vertical to a horizontal plane.

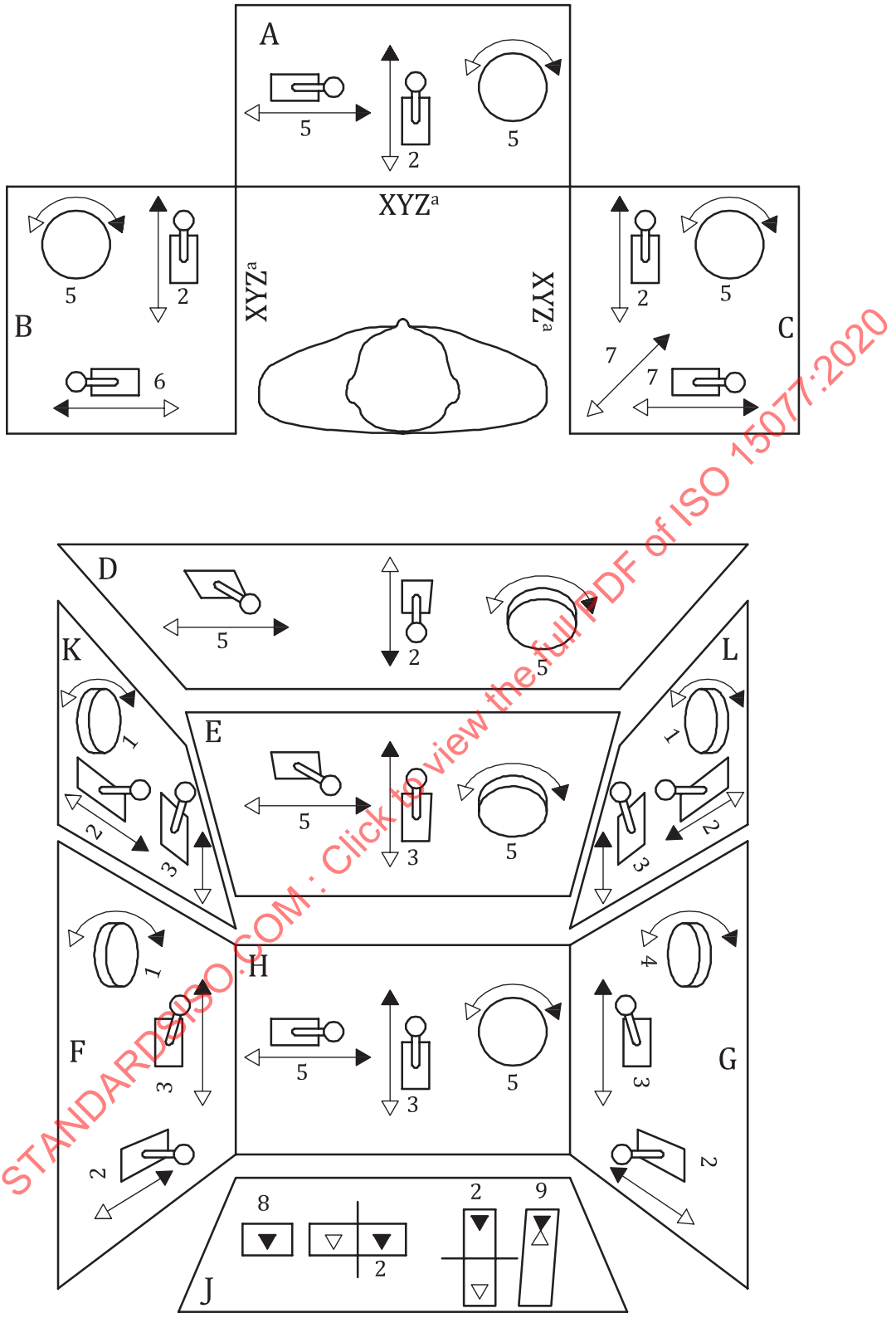
A.2.3.4 When a sequence of controls is repeated on another panel, the sequence of controls should be the same for each panel.

A.2.3.5 Control design and spacing should allow unobstructed operation without unintentional actuation of other controls. Overlapping of controls is permissible to provide independent or simultaneous control application.

A.3 Direction of motion

A.3.1 Preferred direction of movement

A.3.1.1 The preferred direction of movement of controls and the anticipated response for the various control locations are shown in Figure A.3. The alternative responses linked to the control movements are described in Table A.2.



Key

→ control movement for the response listed

⟶ opposite response for the black-headed arrows

a Sequential order for related controls: if a normal or natural order exists for related controls, the order on different panels should be in the sequence shown.

Figure A.3 — Typical alternative control movements

Table A.2 — Alternative responses

1	2	3	4	5	6	7	8	9
Increase	Increase	Increase	Increase	Increase	Increase	Increase	On	Increase
On	On	On	On	On	On	On		
Start	Start	Start	Start	Start	Start	Start		
Forward	Forward	Forward	Backward	Clockwise	Anti-clockwise	Clockwise		
Clockwise	Down	Up	Clockwise	Right	Down	Down		
	Lower	Raise			Lower	Lower		
					Left	Right		

A.3.2 Controls — General

A.3.2.1 Manual hydraulic valves rotate clockwise to shut off flow.

A.3.2.2 Push-pull controls should pull for “ON” and push for “OFF”. Rotary controls may have their on-off functions activated by the same push-pull principle.

A.3.2.3 Lever motion indicated in the figure represents the motion of several control types such as levers, rocker switches, sliders and pairs of push buttons.

A.3.3 Controls — Location and movement recommendations

A.3.3.1 In panels B and C, right-left actuated control usage can lead to control ambiguity and should be avoided.

If a rotary control on panel G is related to, or operated simultaneously with, a rotary control on panel F, the control motion should be opposite to that shown on G for backward, increase, on, and start.

Levers on panels B and C may be oriented at an angle to provide movement away from, and towards, the operator provided the general principles of operation are met.

Annex B
(normative)

Operator controls associated with virtual terminals

B.1 General

Operator controls associated with virtual terminals include, but are not limited to, auxiliary input units as defined in ISO 11783-6, proprietary control units, soft keys and data masks (for example, buttons). These controls also include the interface elements of the virtual terminal that activate the soft keys and data mask objects such as bezel buttons, touch screens or keypads. Critical functions shall only be controlled by critical VT operator controls.

B.2 Marking and labelling of controls

B.2.1 Markings

B.2.1.1 Each VT operator control shall be permanently marked. VT operator controls that have more than one actuation position or direction (for example, joysticks, multi-position switches) shall be marked for each actuation position or direction. Each VT operator control designator displayed on the virtual terminal shall display the corresponding markings.

NOTE Soft keys physically located relative to the VT operator control designator displayed on the screen such that the relationship is clear need not be provided with additional markings.

B.2.1.2 Auxiliary input units and other input units intended to be installed by the operator shall be marked to show the intended mounting orientation.

B.2.2 Labels

Auxiliary input units shall be designed in such a way as to allow 20 mm^2 or larger labels to be applied either on or near the VT operator control. Other data mask objects that can control critical functions (for example, touch screen button objects) shall be provided with labels which are clearly visible. Appropriate labels shall be provided by the function owner (for example, implement). Symbols, when used, shall conform to ISO 3767-1 or ISO 3767-2.

NOTE The label area for virtual terminal soft keys is provided in the soft key designator specified in ISO 11783-6.

B.3 Installation

Manufacturers of input units intended to be installed by others (for example, auxiliary input units) shall publish and provide installation instructions to ensure the input unit is mounted in the correct orientation and in such a way as not to interfere with other controls and reduce the likelihood of inadvertent actuation of VT operator controls. Wired input units intended to be used within the operator station shall be equipped with connection cables of appropriate length to allow proper mounting, but not so long as to allow the unit to be operated outside of the operator station.