INTERNATIONAL STANDARD

ISO 7752-1

Second edition
2010-06-01

Cranes — Control layout and characteristics —

Part 1: General principles

Appareils de levage à charge suspendue — Disposition et caractéristiques des commandes —

Partie 1: Principes généraux

Reference number
ISO 7752-1:2010(E)

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Published in Switzerland

Foreword

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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 7752-1 was prepared by Technical Committee ISO/TC 96, *Cranes*, Subcommittee SC 7, *Tower cranes*.

This second edition cancels and replaces the first edition (ISO 7752-1:1983), which has been technically revised.

ISO 7752 consists of the following parts, under the general title *Cranes — Control layout and characteristics*:

— *Part 1: General principles*

— *Part 2: Mobile cranes*

— *Part 3: Tower cranes*

— *Part 4: Jib cranes*

— *Part 5: Overhead travelling cranes and portal bridge cranes*

Cranes — Control layout and characteristics —

Part 1:
General principles

1 Scope

This part of ISO 7752 establishes principles and requirements for the controls of cranes. It deals with the arrangement of those controls used in positioning loads and serves as a general basis for the elaboration of detailed standards covering the controls of particular types of cranes.

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 12100, *Safety of machinery — General principles for design — Risk assessment and risk reduction*

IEC 60068-2-27, *Environmental testing — Part 2-27: Tests — Test Ea and guidance: Shock*

IEC 60068-2-31, *Environmental testing — Part 2-31: Tests — Test Ec: Rough handling shocks, primarily for equipment-type specimens*

IEC 60204-32:2008, *Safety of machinery — Electrical equipment of machines — Part 32: Requirements for hoisting machines*

3 Terms and definitions

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

3.1
operator
person operating the crane for the purposes of positioning loads

3.2
address code
number used by a receiver to differentiate the frames sent by its transmitter

NOTE The receiver only carries out commands received from a transmitter having the same address code.

3.3
wireless control
means by which the crane operator's commands are transmitted without any physical connection for at least part of the distance between the console and the crane

3.4
console
fixed or moveable arrangement of controls

3.5
control
actuating device which forms an interface between the crane operator and crane control system

3.6
control station
permanent position of controls on or off the crane

3.7
error detection code
number added to each frame to enable the receiver to detect transmission errors

NOTE The receiver redefines the error detection code using an algorithm similar to the one used in the transmitter. The commands are only carried out if the error detection code so defined by the receiver is identical to the error detection code it received with the frame.

3.8
frame
"package" of bits which the transmitter sends to the receiver

EXAMPLE Address code, operating command signals, other control signals, error detection (and correction) code.

NOTE The frame is formed out of the above-mentioned parts by coding them into a serial form. After this coding, the frame is sent to a circuit called a *modulator* which transforms it into a suitable form for sending.

3.9
hamming distance
number of positions in which two code words of the same length differ from one another

[IEC/TR 60870-1-3]

3.10
operating command
control signal intended to initiate, modify or maintain a crane function/movement

3.11
receiver
part of a wireless control system which receives the commands from the transmitter

3.12
transmitter
part of a wireless control system which sends the crane operator's commands to the receiver

4 Controls

4.1 General

4.1.1 The function of the controls of power-operated cranes is to permit an operator to position a load from a control station that could be remote from the machinery powering the motions of the crane.

4.1.2 Controls and control stations shall conform to the safety requirements and/or protective measures of this clause. In addition, controls and control stations shall be designed according to the principles of ISO 12100.

4.1.3 Where applicable and desirable for safety (for example with certain electric cranes), an emergency stop shall be provided close to each control station.

In particular, when a remote control station is provided, an emergency stop covering all motions shall be provided.

4.1.4 Controls for crane movements, when released, shall automatically return to the “off” position. An exception to this is the “stop” control.

Control levers shall, where necessary and appropriate, be provided with stops, detents or any other mechanism to facilitate operation. All control levers shall return to their neutral positions automatically upon release, when not knuckled or toggled in.

4.1.5 In order to prevent unintended movement of a crane motion, the motion shall only be able to be initiated from the neutral position of the control. Where this is not practicable, other means shall be provided as specified in the International Standards for particular crane types.

4.1.6 Protection against electric shock for direct or indirect contact shall be as specified in IEC 60204-32:2008, Clause 6.

4.1.7 The temperature of controls, as generated by the crane's operation, shall not exceed 43 °C.

4.2 Operator fatigue

4.2.1 The controls of a crane shall, consistent with the duty of the crane, be designed and positioned on ergonomic principles to minimize operator fatigue.

4.2.2 The force required to actuate the control levers shall lie between the following values:

— forwards or backwards: between 5 N and 60 N;

— sideways, to the left or to the right: between 5 N and 20 N, with a maximum actuating force of 40 N being acceptable for levers at control stations subjected to substantial accelerations.

4.2.3 For pedals, the force shall not exceed the following maximum values:

— pedals actuated by a movement of the ankle: 50 N;

— pedals actuated by a movement of the leg: 100 N, excepting the hydraulic brake pedal.

4.2.4 For pushbuttons actuated by finger or thumb, the force shall not exceed a value of 10 N, excepting

— double-action pushbuttons, for which the force needed to maintain the “on” position shall not exceed 10 N,

— emergency pushbuttons, and

— buttons for direct control of power.

4.2.5 For pushbuttons actuated by foot, the force shall not exceed a value of 100 N.

4.2.6 The maximum force required to operate hand-driven movements shall not exceed the following values:

— vertical force on a hauling chain: 250 N;

— horizontal force when pushing against or hauling on the load: 250 N;

— force applied to the handle of a crank or hand-wheel: 150 N;

— force applied to a lever with horizontal movement: 250 N.

4.3 Control arrangement

4.3.1 As far as possible, the control levers (pedals or pushbuttons) shall be placed so that the operator's hands or feet position themselves on the controls naturally. Where possible, the direction of movement of the control should be in line with the natural movement of the limb: for example, foot controls should be operated by the pressure of the foot, not by a sideways movement of the leg.

4.3.2 The direction of movement of control levers shall, whenever possible, be consistent with crane motion.

The logic of the control arrangement shall be the same at each control station associated with operating the crane.

4.3.3 The arrangement of the controls for a particular crane type shall be as specified in the appropriate International Standards for that crane type.

4.3.4 Symbols shall be fixed on or near the control and the function shall be identified. The relationship between the movement of the control lever in the control station and the corresponding direction of motion shall be clear and unambiguous.

4.3.5 Where the position of a console is variable with regard to the movement of the crane or part of the crane, there shall be an unambiguous means of showing the relationship between operating the controls and the resultant movements of the crane. Symbols shall be fixed such that there is a clear and unambiguous indication of the relationship between the movement of the control and the corresponding driving direction.

4.3.6 Controls shall be positioned so that, when the operator is intentionally engaging one or several controls, inadvertent engagement of another control is unlikely.

4.3.7 Controls shall be designed or protected so that the desired effect can only occur by an intentional operation.

This can be achieved by

— recessing the actuator (lever, pushbuttons),

— mechanical interlock of the neutral position of the control lever,

— use of a set of actuators requiring sequential or simultaneous actions,

— surrounding the control levers on a panel by a guard-rail,

— locating the actuator where it is unlikely to be accidentally knocked.

4.3.8 The free space between each control and its surroundings should be enough to avoid unintended movements. If bare hands are used, the free space should not be less than

— 50 mm for operating handles that require a force of > 50 N,

— 25 mm for operating handles that require a force of $\leqslant 50$ N,

— 10 mm between rows of pushbuttons or switches,

— 15 mm between separate pushbuttons,

— 5 mm for pushbuttons that do not operate any movement of the crane or its lifting accessories,

— 100 mm for pedals, and

— 5 mm between pushbuttons, up to a maximum of four buttons for hand-held consoles.

5 Consoles

5.1 General

5.1.1 Crane consoles shall have a control to activate an acoustic warning device to alert persons in the vicinity of the crane, unless otherwise specified in the appropriate International Standard for the particular crane type. The control for any acoustic warning device shall be different from the crane operating controls.

5.1.2 Portable consoles (equipment) shall be provided with an adjustable strap to allow the console to be carried without using the hands. Hand-held equipment may alternatively be fitted with a safety strap or other equivalent means to prevent it from being dropped. The consoles shall be capable of withstanding the shock and rough-handling tests as specified in IEC 60068-2-27 and IEC 60068-2-31.

5.1.3 Where a crane has more than one console, measures shall be taken to ensure that only one console is operational at a given time. Exceptionally, the stop command of any hardware-connected console shall be effective where necessary for safety reasons.

5.2 Cable-connected consoles

5.2.1 Pendant consoles shall be so positioned that the crane operator is able to position himself outside the danger zone.

5.2.2 For cranes where the crane operator has to follow, on foot, the movement of the crane console or its load, the speed of the travel motions shall be limited as follows:

a) for one speed control: 1,1 m/s maximum;

b) for two speeds or more, including stepless: no limitation, provided that the slowest selectable speed is 0,75 m/s or less.

5.2.3 Where suspended consoles are independently power-driven for repositioning, protection shall be provided to prevent inadvertent movement

a) of the crane when the console is being repositioned,

b) of the console when other crane controls are being operated.

5.2.4 A control cable between a crane and console shall be of sufficient length and flexibility to allow the operator to maintain a safe operating position.

5.2.5 The distance from the underside of a suspended console to the floor shall be at least 0,9 m and that from the top of the console to the floor shall be a maximum of 1,7 m.

5.2.6 With regard to pulling forces, the electrical flexible cables and fittings used in cable-connected consoles shall conform to the requirements of IEC 60204-32:2008, 14.4.2 and 14.4.3. Similar precautions shall be taken for other types of control system with physical connections.

5.3 Wireless controls and control systems

Annex A provides values additional to the requirements for wireless control systems specified in IEC 60204-32.