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Earth-moving machinery — Hydraulic excavator and backhoe loader lowering control device — Requirements and tests

Engins de terrassement — Dispositif de contrôle d'abaissement de la flèche des pelles et chargeuses-pelleteuses hydrauliques — Exigences et méthodes d'essai

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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).

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This document was prepared by Technical Committee ISO/TC 127, *Earth-moving machinery*, Subcommittee SC 1, *Test methods relating to safety and machine performance*.

This fourth edition ~~is a minor revision that~~ cancels and replaces the third edition (ISO 8643:2017), ~~It has been editorially revised and contains the following~~, of which it constitutes a minor revision. The changes are as follows:

— ~~—~~ “lowering control device” has been changed to “linkage control valve” in [4.8 \(Table 1\)](#), [5.3.2](#), [5.3.3](#), [5.3.4](#), [5.3.5](#) and [5.3.6.2](#) ~~the following clauses as-~~.

~~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 was incorrectly changed during publication of ISO 8643:2017.~~

- ~~—~~ 4.1.8, Table 1,
- ~~—~~ 5.3.2,
- ~~—~~ 5.3.3,

- ~~5.3.4,~~
- ~~5.3.5 (3 places),~~
- ~~and, 5.3.6.2.~~

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Introduction

Where excavators or backhoe loaders are used for object handling, a failure or rupture in the hydraulic circuit can endanger persons under raised loads.

This risk can be reduced by applying a lowering control device, which ensures controlled lowering of the load in the case of a hydraulic line failure or rupture.

Test procedures are based on the design characteristics of the hydraulic systems of hydraulic excavators and the backhoe part of backhoe loaders, and conditions of use.

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Earth-moving machinery — Hydraulic excavator and backhoe loader lowering control device — Requirements and tests

1 Scope

This document establishes uniform requirements and test procedures for lowering control devices fitted on the boom, intermediate boom and arm cylinders of hydraulic excavators and backhoe loaders to control the rate of drop in the case of a hydraulic line failure or rupture.

It is applicable to the lowering control devices of hydraulic excavators and the backhoe equipment of backhoe loaders used for object handling which are equipped with the standard linkage as defined by the manufacturer. On machines where alternative linkage combinations are offered, only the standard length defined by the manufacturer is subject to testing.

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 6165, *Earth-moving machinery — Basic types — Identification and ~~terms and definitions~~ vocabulary*

ISO 9248:1992, *Earth-moving machinery — Units for dimensions, performance and capacities, and their measurement accuracies*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 6165 and the following apply.

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

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

3.1

linkage control system

hydraulic control components (including pilot and slave valves) used for raising and lowering the *lift point* (3.7) in *object handling* (3.9) applications

3.2

lifting linkage

assembly of parts that can be a combination of booms and arms used for raising and lowering the *lift point* (3.7) in the *object handling* (3.9) process

3.3

lowering control device

hydraulic control valves used for controlled linkage lowering in the case of a hydraulic line failure or rupture

3.4

failure-simulation device

hydraulic valves used for simulating a failure or rupture in a hydraulic line in the *linkage control system* (3.1)

3.5

signal line

hydraulic circuit that is used to sense a pressure

EXAMPLE Diagnostic test port, stability limit system.

3.6

rated lift capacity

smaller of either the rated tipping capacity or the rated hydraulic lift capacity

[SOURCE: ISO 10567:2007, 3.13], modified — In the definition, “rated tipping load” has been changed to “rated tipping capacity”.

3.7

lift point

LP
location on the attachment (e.g. bucket) or the quick coupler, as specified by the manufacturer, to which a load can be attached

[SOURCE: ISO 10567:2007, 3.2, modified] — In the definition, “the bucket or the attachment bracket” has been changed to “the attachment (e.g. bucket) or the quick coupler”.

3.8

lift point radius

LPR
horizontal distance from the axis of rotation to the vertical hoist line or tackle

[SOURCE: ISO 10567:2007, 3.5]

3.9

object handling

application of earth-moving machinery comprising lifting, lowering and transporting of a load by use of lifting accessories, whereby the assistance of a person or the operator of the machine is required for hooking, unhooking or stabilizing (whilst transporting) the load

Note 1 to entry: If the load is picked-up by a self-acting device and no assistance of a person is required for hooking, unhooking or stabilizing the load, this work is considered as a usual earth-moving application.

Note 2 to entry: Lifting accessories are, e.g. wire ropes, chains or textile straps; loads in object handling application are, e.g. pipes, vessels; self-acting devices are, e.g. grabs, clamshell buckets, log clamps, vacuum lifting device, magnetic plate or fork.

4 Lowering control device requirements

~~4.1~~ Lowering control devices shall comply with the requirements given in ~~4.14.1.1~~ to ~~4.84.1.8~~.

~~4.1.1~~ The lowering control device shall operate automatically while the cylinders in the linkage control system that keep the load in a lifted position are pressurized, even if the machine/ignition is switched off.

~~4.1.2~~ The operation of the lowering control device shall not detract from the normal response of the machine during use and shall not at any time endanger the stability of the machine.

~~4.1.3~~ A relief valve to protect the cylinder may be fitted between the cylinder and the lowering control device.

~~4.1.4~~ In the case of a failure in the linkage control system, lowering the load shall be possible without endangering persons or the stability of the machine.

~~4.1.5~~ Each cylinder in the linkage control system that keeps the load in a lifted position shall have the following secured to it:

- a) ~~a)~~ the lowering control device as well as related tubes and fittings between the lowering control device and the cylinder (hoses are not acceptable);
- b) ~~b)~~ when provided, a separate relief valve (see ~~4.34.1.3~~) as well as related tubes and fittings to connect it in parallel with the lowering control device.

Tubes and fittings related to connecting the control valve, and the relief valve when provided in parallel to the cylinder, shall have a minimum burst pressure of four times the working circuit pressure for that part of the system.

~~4.1.6~~ If signal lines are present, then rupture of one of these lines shall result in an oil leakage of not more than 10 ~~l~~/min for each cylinder at an oil temperature of approximately 40 °C to 50 °C at the specified working circuit pressure.

~~4.1.7~~ If equalizing lines between cylinders are present, then rupture of one of these lines shall result:

- for machines with an operating mass (according to ISO 6016) of up to 40 t — in an oil leakage lower than 10 ~~l~~/min for each cylinder at an oil temperature of 40 °C to 50 °C at the specified working circuit pressure;
- for machines with an operating mass (according to ISO 6016) equal to or greater than 40 t — in a cylinder stroke speed lower than 3 % per second of the total stroke for each cylinder at an oil temperature of 40 °C to 50 °C at the specified working circuit pressure.

NOTE Further investigation concerning the application of the requirement to arm cylinder equalizing line is needed; in the meantime, the requirement can be applied to the arm cylinder as well.

~~4.1.8~~ Performance requirements

Lowering; lowering control devices (and equalizing or signal lines, if present) shall be tested in accordance with the test conditions and acceptance criteria given in Table 1 ~~Table 1~~.

Table 1 — Performance requirements

Test condition	Test load setup height	Machine and control setup	Acceptance criteria	Ref.
Testing of internal leakage	1,0 m ± 0,1 m above ground	All controls in neutral	Vertical drop rate ≤ 10 mm/s	5.3.2 5.3.2
Holding position	1,0 m ± 0,1 m above ground	All controls in neutral Failure-simulation device opened	Total vertical drop in 10 s ≤ 100 mm	5.3.3 5.3.3
Raising	1,0 m ± 0,1 m above ground	Raise smoothly and continuously Failure-simulation device opened Keep linkage control valve in position	Total vertical drop in 10 s ≤ 100 mm	5.3.4 5.3.4
Lowering	1,0 m ± 0,1 m above ground or higher minimum height so that the test load does not come into contact with the ground surface during the test	Lower smoothly and continuously Failure-simulation device opened All controls in neutral	— —The increase in the lowering speed of the test load shall be less than 100 % increase of the initial speed averaged over a period of at least 2 s — —Total vertical drop in 10 s ≤ 100 mm	5.3.5 5.3.5
Equalizing/ Signal lines	No load	Linkage at maximum lift height	— —≤ 40 t: oil leakage < 10 l /min — —> 40 t: a cylinder stroke speed of not more than 3 % per second of the total stroke for each cylinder	5.3.6 5.3.6

5 Test method

5.1 Apparatus

5.1.1 Means of measuring displacement in the vertical plane against time, to an accuracy according to ISO 9248:1992.

Scales and stopwatches are allowed provided they meet the requirement on accuracy indicated in [5.1.1](#)~~5.1.1~~.

5.1.2 Thermometer, or equivalent temperature measuring device, measuring from 0 °C to 100 °C with an accuracy of ± 1 °C.

5.1.3 Collecting container, for hydraulic oil, or alternatively, an oil return line to the tank.