

# INTERNATIONAL STANDARD

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## **Earth-moving machinery — Hydraulic excavator and backhoe loader boom-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*



Reference number  
ISO 8643:1997(E)

## Foreword

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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.

International Standard ISO 8643 was prepared by Technical Committee ISO/TC 127, *Earth-moving machinery*, Subcommittee SC 2, *Safety requirements and human factors*.

This second edition cancels and replaces the first edition (ISO 8643:1988), which has been technically revised.

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## Introduction

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

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

Test procedures are based on the special 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 boom-lowering control device — Requirements and tests

## 1 Scope

This International Standard establishes uniform requirements and test procedures for boom-lowering control devices fitted on boom-lift cylinders to control the rate of drop in the case of a hydraulic line failure or rupture.

This International Standard applies to boom-lowering control devices on hydraulic excavators and the backhoe part of backhoe loaders, when used for handling and lifting objects.

## 2 Normative reference

The following standard contains provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 6165:1997, *Earth-moving machinery — Basic types — Vocabulary*.

## 3 Definitions

For the purposes of this International Standard, the definitions given in ISO 6165 and the following definitions apply.

**3.1 boom control system:** Hydraulic control valve(s) (including pilot and slave valves) used for raising and lowering the boom.

**3.2 boom lowering control device:** Hydraulic control valve(s) used for controlled boom lowering.

**3.3 failure-simulating device:** Hydraulic valve(s) used for simulating a hydraulic line rupture in the boom circuit.

**3.4 rated lift capacity:** The smaller of either the rated tipping capacity or the rated hydraulic lift capacity.<sup>1)</sup>

**3.5 lift point:** One point as defined by the manufacturer for the purpose of lifting. It is defined by the lift point height and the lift point radius.

**3.6 lift point height:** Vertical distance from the lift point to the ground reference plane (GRP).

1) From: ISO 10567:1992, *Earth-moving machinery — Hydraulic excavators — Lift capacity*.

**3.7 lift point radius:** Horizontal distance from the lift point to the axis of rotation.

## 4 Requirements for object handling

**4.1** For hydraulic excavators and the backhoe part of backhoe loaders used in object handling, a lowering control device shall be provided which prevents uncontrolled lowering of the boom in the case of a hydraulic line failure or rupture.

**4.2** The devices shall operate automatically while the boom-lift cylinders are pressurized. These devices are considered satisfactory when performance meets the requirements defined in clause 5.

For testing the device, the drop rate of the load due to internal leakage in the system shall not exceed 10 mm/s when the control is in the neutral position.

The operation of the device shall not detract from the normal response of the machine and shall not, at any time, endanger the stability of the machine.

**4.3** A relief valve to protect the cylinder may be fitted between the cylinder and the control device.

**4.4** In the case of a failure of the boom control system, or after a boom line rupture, lowering of the load shall be possible without endangering person(s) or the stability of the machine.

**4.5** The boom-lift cylinder shall have the following firmly attached to it:

- a) the control device as well as related tubes and fittings between the control device and the cylinder; and
- b) when provided, a separate relief valve as well as related tubes and fittings to connect it in parallel with the 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.

**4.6** Signal lines for testing device(s) and equalizing lines between lift cylinders are permissible, if rupture of one of these lines results 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.

## 5 Test method

### 5.1 Apparatus

#### 5.1.1 Stopwatch

#### 5.1.2 Measuring tape or scale

#### 5.1.3 Thermometer, measuring from 0 °C to 100 °C.

#### 5.1.4 Measuring container, of 2 litre capacity, or a flowmeter.

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

#### 5.1.6 Test load, of mass $(50 \pm 10)$ % of the rated lift capacity at a specific lift point radius.

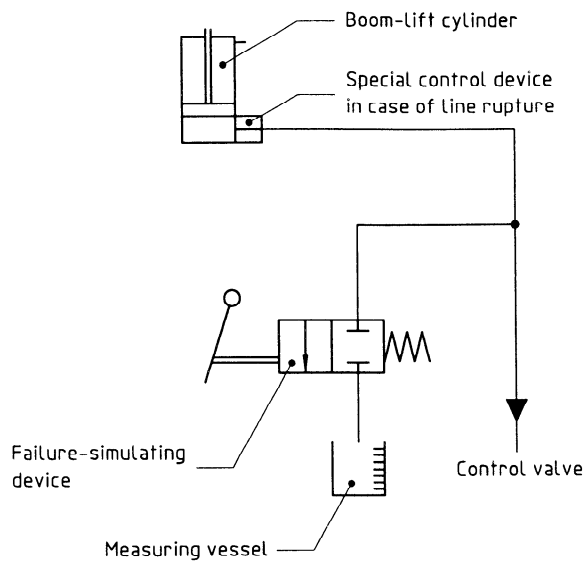
### 5.2 Preparation for test

**5.2.1** Test methods ensuring equal results should be used, for example a level site near a vertical wall to which a paper is pinned to record the load displacement in the tube or hose-rupture simulation test, when the load is fitted with a stylus.

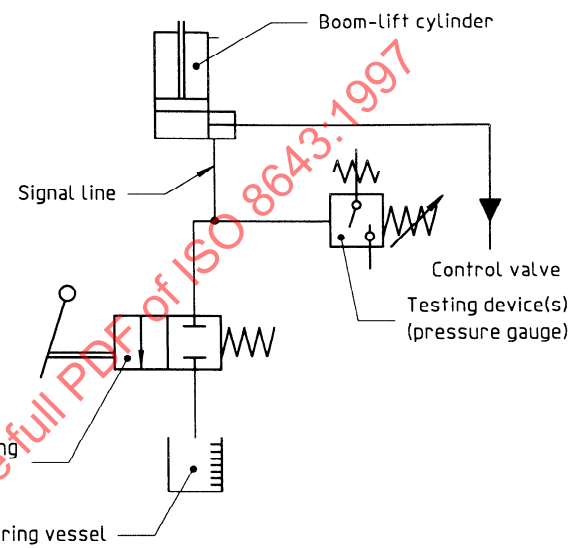
**5.2.2** A failure-simulating device shall be installed in any connecting line whose failure could cause the boom to lower. The tube for testing shall not increase the resistance of the connecting line.

Examples of such installations are as follows:

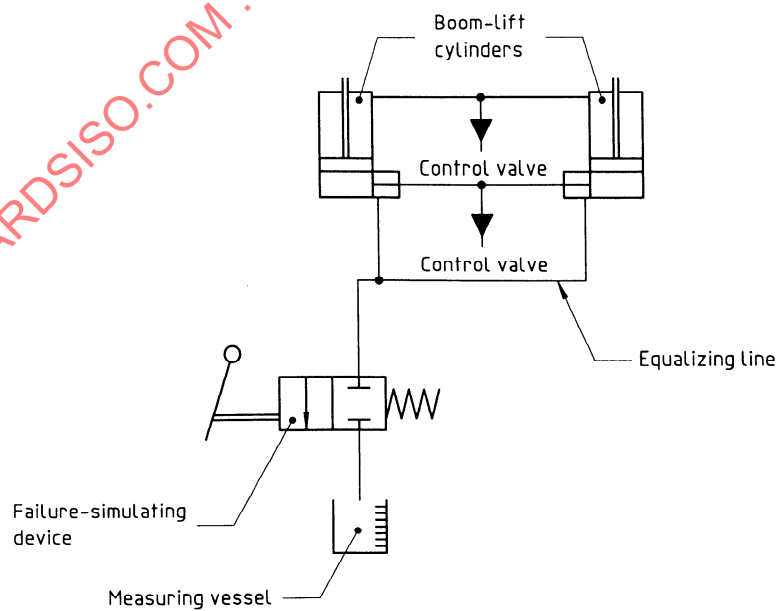
- in the line between the boom-lift cylinder and control valve, as shown in figure 1;
- in the signal line between the boom-lift cylinder and testing device (pressure gauge), as shown in figure 2;
- in the equalizing line between the boom-lift cylinders, as shown in figure 3.



**Figure 1**



**Figure 2**



**Figure 3**

**5.2.3** The complete hydraulic system shall be operated until the temperature of the hydraulic oil in the oil reservoir is approximately 40 °C to 50 °C. The hydraulic fluid shall be of the type and grade specified by the manufacturer.

### **5.3 Testing of control device**

**5.3.1** The test load shall be at the lift point radius which results in a moment equal to  $(50 \pm 10)$  % of the moment developed by the rated lift capacity at a specific lift point radius.

**5.3.2** The functions of raising and lowering the boom shall be smooth and at a reduced speed of 200 mm/s max., measured at the test load.

**5.3.3** The load shall be lowered and set down after each test in accordance with 4.5.

### **5.4 Testing of holding position**

**5.4.1** The test load shall be raised approximately 1 m above ground level, with the boom control valve(s) in the neutral position.

**5.4.2** The failure-simulating device between the lift cylinders and the boom control valve shall be opened.

**5.4.3** The total drop of the load during the initial 10 s shall be measured; it shall not exceed 100 mm.

### **5.5 Testing during raising**

**5.5.1** The test load shall be lifted smoothly and continuously without shock (see 5.3.2).

**5.5.2** The failure-simulating device between the lift cylinder(s) and the boom control valve shall be opened.

**5.5.3** The total drop of the load during the initial 10 s shall be measured; it shall not exceed 100 mm.

### **5.6 Testing during lowering**

**5.6.1** The test load shall be lowered smoothly and continuously without shock (see 5.3.2).

**5.6.2** The failure-simulating device between the lift cylinder(s) and the boom control valve shall be opened.

**5.6.3** The increase in the lowering speed of the test load shall be less than 100 % increase of the initial speed. After the control is moved to the neutral position, the boom-lowering control device shall be able to limit boom movement so that the total drop of the load during the initial 10 s of the test does not exceed 100 mm.

### **5.7 Testing of equalizing lines or signal lines**

**5.7.1** Testing shall be performed without load.

**5.7.2** The boom shall be raised to its maximum lift height, and the boom control valve kept in the "lift" position.

**5.7.3** The failure-simulating device shall be opened.

**5.7.4** The oil leakage per cylinder shall not exceed 10 l/min.

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