127

INTERNATIONAL STANDARD

ISO 5004

Second edition
1987-04-15

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION
ORGANISATION INTERNATIONALE DE NORMALISATION
МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ

Earth-moving machinery — Test method for measurement of tool movement time

Engins de terrassement — Méthode d'essai pour le mesurage du temps de mouvement des outils

Withdrawn

Reference number
ISO 5004 : 1987 (E)

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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 5004 was prepared by Technical Committee ISO/TC 127, *Earth-moving machinery.*

This second edition cancels and replaces the first edition (ISO 5004:1981) of which it constitutes a minor revision.

Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.

Printed in Switzerland

Earth-moving machinery — Test method for measurement of tool movement time

1 Scope and field of application

This International Standard specifies the method of measuring the movement time, for example, raising, lowering or slewing, of hydraulically operated tools and components of wheeled and track-laying earth-moving machines. The test method is applicable to tools both laden and unladen.

2 Reference

ISO 5998, *Earth-moving machinery — Rated operating load for crawler and wheel loaders.*

3 Definitions

For the purposes of this International Standard, the following definitions apply.

3.1 tool: Component of a machine designed to perform a specified function, the movement time of which is to be determined.

3.2 upper structure: Part of the machine which is able to slew or rotate about a vertical axis relative to the undercarriage of the machine and to which a tool is attached.

3.3 tool movement: Path through which the tool is moved. This is usually the maximum possible movement permitted by the operating cylinders, for example, from cylinder fully extended (open) to cylinder fully retracted (closed).

3.4 rotational movement of the upper structure: Angle through which the upper structure slews or rotates.

3.5 tool movement time: Time taken for the tool to complete its movement, where the movement is usually the maximum allowed by the operating cylinders.

3.6 rotational movement time: Time taken for the upper structure to rotate through a measured angle.

3.7 operating pressures: Operating pressures of the hydraulic system, as recommended by the manufacturer.

3.8 *engine speed*: Manufacturer's specified maximum governed speed (with the operating lever at the maximum position).

3.9 *rated operating load*: Nominal value of the load applied to the bucket or tool and which represents normal loading under typical conditions as specified and determined in accordance with the appropriate International Standard (for example, ISO 5998).

4 Apparatus

The following apparatus is required.

4.1 Stop watch, accurate to ± 0,1 s.

4.2 Protractor, accurate to ± 1°.

4.3 Pressure gauge for hydraulic system, accurate to ± 5 %.

4.4 Engine tachometer, accurate to ± 5 %.

4.5 Tyre pressure gauge.

5 Preparation for test

5.1 The test shall be carried out on a hard level surface with no obstruction to tool movement. In the case of tools which operate below ground level, such as a ripper or excavator bucket, the machine shall be positioned so that the tool projects into an open pit at one edge of the hard surface.

5.2 The machine, together with its tool, shall be in its normal working condition with the engine set to run at the speed specified in 3.8. The operating pressures shall be checked to ensure that they are in accordance with the manufacturer's recommendations (see 3.7). The tyres shall be inflated to the manufacturer's recommended normal pressures.

5.3 Immediately prior to the test, the machine shall be run for a period sufficient to ensure that the engine, transmission, oils, coolant and hydraulic components are at their normal working temperatures.

6 Procedure

6.1 The machine, prepared as in clause 5, shall be located on the test site in its normal working position, which is to be shown in a drawing in the test report. The tool under examination shall be operated in the manner normally used when operating the machine in accordance with the manufacturer's instructions.

6.2 Before conducting any test, it is advisable for the operator to familiarize himself with the movement of the tool or component by operating it several times in the manner required in the actual test.

6.3 Movement times shall be assessed:

a) normally, over the complete travel of the hydraulic cylinder or other means of actuating the particular tool movement, i.e. from fully extended to fully retracted, or vice versa;

b) additionally, where specific measurements are required (for example ground line to maximum lift height), these times together with the specific test conditions.

6.4 When a movement can be made using more than one cylinder or motor system (for example, in a hydraulic excavator the bucket can be moved by using the boom lift and/or dipper and/or bucket cylinder separately or in combination), only one cylinder or motor system shall be used for the test; the one used shall be stated in the results.

6.5 When satisfied that the machine and its tools are prepared as the test requires, the tester shall then time the specified movement not less than three times to obtain a reliable mean value for the movement time. (See table 1.)

6.6 Movement time measurements shall be made under the following conditions:

a) The measurement to determine the movement time of a laden tool shall be made with the tool carrying the ISO rated operating load (see 3.9).

b) Where the tool would normally discharge its load during the movement, the load shall be retained throughout the test to ensure that uniform repeatable conditions are maintained.

c) The measurements to determine the raising time of a bucket shall be taken in two modes:

1) with the bucket empty, and

2) with the bucket filled with material to the ISO rated operating load (see 3.9).

d) The measurements to determine the lowering time of a tool shall be taken with the tool unladen. The lowering time shall be the minimum time in either the power-down or float-down mode. The manner in which the tool is lowered shall be stated in the results.

6.7 The speed of slewing or rotating shall be measured for continuous slewing with attachments fully extended at maximum working radius and without any load by measuring the time taken for a specific angle of rotation and then calculating the rotational frequency, or by measuring the rotational frequency. The rotational frequency in both directions shall be measured and reported, unless it is the same in both directions when only one figure need be reported. (See table 2).

7 Accuracy of measurements

The following measurement accuracies shall be met:

a) Time: the variation between three or more consecutive measurements shall not exceed ± 0,2 s;

b) Angle of rotation: ± 5°.

8 Test report

The following information shall be recorded in the test report:

a) type of machine;

b) make of machine;

c) model of machine;

d) machine number;

e) details of equipment fitted;

f) hydraulic operating pressures (see 3.7);

g) manufacturer's specified governed engine speed (see 3.8);

h) tool movement times, calculated as shown in tables 1 and 2;

i) specific test conditions as given in 6.3, 6.6 and 6.7;

j) a drawing showing the working position (see 6.1).

Table 1 — Tool movement time

Tool and movement observed, for example bucket raising

State load of bucket

Hydraulic cylinder or motor used, for example, lift arm(s) cylinder(s)

Test No.	Time s
1	t_1
2	t_2
3	t_3
4	t_4
...	...
n	t_n

Tool movement time, in seconds: $\dfrac{t_1 + t_2 + t_3 + \ldots t_n}{n}$

Table 2 — Rotational frequency

Test No.	Rotational frequency min^{-1}	Time for α degrees of movement s
1	N_1	t_1
2	N_2	t_2
3	N_3	t_3
...	...	...
n	N_n	t_n

Rotational frequency: $\dfrac{N_1 + N_2 + N_3 + \ldots N_n}{n}$ min^{-1}

or

$$\frac{60 \times n}{t_1 + t_2 + t_3 + \ldots t_n} \times \frac{\alpha}{360} \ min^{-1}$$