

International Standard



3471/1

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

Earth-moving machinery — Roll-over protective structures — Laboratory tests and performance requirements —

Part 1: Crawler, wheel loaders and tractors, backhoe loaders, graders, tractor scrapers, articulated steer dumpers

*Engins de terrassement — Structures de protection au retournement — Essais de laboratoire et critères de performance —
Partie 1: Chargeuses et tracteurs sur chenilles et sur roues, chargeuses-pelleteuses, niveleuses, décapeuses et tombereaux avec avant-train*

First edition — 1986-06-15

UDC 621.878-788

Ref. No. ISO 3471/1-1986 (E)

Descriptors : earth moving equipment, loaders, tractors, graders, scrapers, dumpers, safety devices, accident prevention, overturning (vehicles), specifications, tests, laboratory tests, labelling.



Documents

Document Sharing Hub

Price based on 15 pages

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 3471/1 was prepared by Technical Committee ISO/TC 127, *Earth-moving machinery*.

It cancels and replaces ISO 3471-1980, clause 7 and figure 5 of which have been technically revised.

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.

Contents

	Page
1 Scope	1
2 Field of application	1
3 References	1
4 Definitions	2
5 Symbols	2
6 General	2
7 Static laboratory tests	3
8 Performance requirements	4
9 Labelling	5
10 Reporting of results	6
Tables 1 and 2	6
Figures	7 to 13
Annexes	
A Standard test report	14
B Test report — Additional information for the originator of the test request	15



Earth-moving machinery — Roll-over protective structures — Laboratory tests and performance requirements —

Part 1: Crawler, wheel loaders and tractors, backhoe loaders, graders, tractor scrapers, articulated steer dumpers

1 Scope

1.1 Part 1 of ISO 3471 sets out

- a) the static laboratory tests for measurement of structural characteristics, and
- b) the requirements for performance in a representative test,

of a roll-over protective structure (ROPS) design; it is closely related to the deflection-limiting volume (DLV) (see ISO 3164).

1.2 The static laboratory tests are means of measuring the characteristics of the structures used to protect the operator at velocities of 0 to 16 km/h (0 to 10 mile/h) over hard clay where roll-over would be limited to a maximum roll angle of 360° down a slope of 30° maximum without penetration of the specified DLV by structural members of the ROPS.

1.3 This part of ISO 3471 is intended to establish a consistent, reproducible means of evaluating force-deflection characteristics of ROPS under static loading and to lay down performance requirements for these structures under such loading in a representative test.

1.4 For the purposes of this part of ISO 3471, "representative test" means a test of a specimen the material, dimensional, and processing requirements of which are typical of those ROPS being produced.

1.5 ISO 3471/2 deals with the requirements for ROPS on machinery for forestry.

2 Field of application

2.1 Part 1 of ISO 3471 applies to the following types of operator-controlled machines as defined in ISO 6165:

- crawler loaders and wheel loaders;

- crawler tractors, wheel tractors and backhoe loaders;
- graders;
- tractor-scrapers;
- articulated steer dumpers (see ISO 7132, figures 3, 5 and 8).

2.2 This part of ISO 3471 does not apply to:

- compactors;
- machines having a power rating less than 15 kW (20 hp);
- excavators;
- drag lines;
- rigid frame dumpers;
- pipelayers.

3 References

ISO 898, *Mechanical properties of fasteners —*

Part 1: Bolts, screws and studs.

Part 2: Nuts with specified proof load values.

ISO 3164, *Earth-moving machinery — Laboratory evaluation of roll-over and falling-object protective structures — Specification for the deflection-limiting volume.*

ISO 3449, *Earth-moving machinery — Falling-object protective structures — Laboratory tests and performance requirements.*

ISO 3471/2, *Earth-moving machinery — Roll-over protective structures — Laboratory tests and performance requirements — Part 2: Machinery for forestry.*¹⁾

¹⁾ At present at the stage of draft.

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

ISO 7132, *Earth-moving machinery — Dumpers — Terminology and commercial specifications*.

4 Definitions

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

4.1 roll-over protective structure (ROPS) : System of structural members arranged on a machine in such a way as to accomplish its primary purpose of reducing the likelihood of an operator, when wearing a seat belt, being crushed should his machine roll over. Structural members include any subframe, bracket, mounting, socket, bolt, pin, suspension or flexible shock absorber used to secure the system to the machine frame but exclude mounting provisions which are integral with the machine frame.

4.2 machine frame : The main chassis or main load-bearing member(s) of the machine which extend(s) over a major part of the machine and upon which the ROPS is directly mounted.

4.3 ROPS-machine frame assembly : The ROPS system attached to the machine frame.

4.4 bedplate : A substantially rigid part of the test structure to which the machine frame is attached for the purpose of the test.

4.5 deflection-limiting volume (DLV) : That volume, related to the operator, which serves to set limits and deflections permissible when performing laboratory evaluations of ROPS and falling-object protective structures (FOPS). The volume, an approximation, is based on the seated dimensions of the larger operator. (See ISO 3164.)

4.6 simulated ground plane (SGP) : Surface on which an earth-moving machine after rolling over is assumed to come to a standstill with the machine lying on its side (see 8.1.2).

5 Symbols

The following symbols and abbreviations are used in this International Standard.

5.1 ROPS : Roll-over protective structure.

5.2 U : Energy absorbed by the structure related to the machine mass, expressed in joules or inches pounds-force.

5.3 F : Force, expressed in newtons or pounds-force.

5.4 M : Machine mass, expressed in kilograms (pounds).

5.4.1 The machine mass is the manufacturer's maximum recommended mass including attachments in operating condition with all reservoirs full to capacity, tools and ROPS;

exclusive of towed equipment such as rollers, compactors, and drawn scrapers. For the tractor scraper and articulated steer dumper, it is the manufacturer's maximum recommended mass of the tractor portion only.

5.4.2 Kingpins, hitches, and articulated steering components that attach to hitches or towed units are excluded from the mass of these machines. Soil, mud, rocks, branches, debris, etc. that commonly adhere to or lie on machines in use are not considered as part of the mass of any machine. Material dug, carried, or handled in any manner is not to be considered part of the machine mass in determining test requirements.

5.5 DLV : Deflection-limiting volume.

5.6 Δ : Deflection of ROPS, expressed in millimetres (inches).

6 General

The following points are stated to aid in understanding the underlying principles, intention and application of this International Standard.

6.1 The ROPS can be integrated into the operator's cab or into the FOPS.

6.2 This evaluation procedure will not necessarily duplicate structural deformation caused by a given actual roll.

6.3 This evaluation procedure is generally destructive of the ROPS-machine frame assembly, as permanent deformation is apt to be induced in either or both.

6.4 Although ROPS meeting these criteria may not give crush protection under all conceivable circumstances in which a machine could overturn, it is expected that crush protection will be ensured under at least the following conditions :

- an initial forward velocity of 0 to 16 km/h (0 to 10 mile/h) on a hard clay surface of 30° maximum slope;
- 360° of roll about the machine's longitudinal axis without losing contact with the slope and without penetration of the DLV by structural members of the ROPS.

6.5 The horizontal force requirement and limitation on deflection (DLV) are intended to ensure that the ROPS will penetrate unfrozen soil thereby giving a braking action to a roll.

6.6 The energy requirement and limitation on deflection (DLV) are intended to ensure that the ROPS will deflect when it strikes or impacts a surface that will not significantly deform (frozen ground, concrete, rock) while retaining significant capability to withstand subsequent impacts.

6.7 The vertical loading requirement is intended to ensure that a deformed ROPS will be able to support the machine when it is upside-down.