

Australian Standard<sup>®</sup>

---

**Earth-moving machinery—  
Protective structures**

**Part 2: Laboratory tests and  
performance requirements for  
roll-over protective structures**

---

[ISO title: Earth-moving machinery — Roll-over protective structures —  
Laboratory tests and performance requirements]

This Australian Standard was prepared by Committee ME/63, Earthmoving Equipment. It was approved on behalf of the Council of Standards Australia on 29 August 1997 and published on 5 December 1997.

---

The following interests are represented on Committee ME/63:

AUSTROADS

Construction and Mining Equipment Association of Australia

Department of Defence

Department of Mineral Resources, N.S.W.

Department of Mines and Energy, Qld

Department of Natural Resources and Environment, Vic.

Metal Trades Industry Association of Australia

Queensland Forest Research Institute

Safety Institute of Australia

Sydney Water Corporation

Telstra Corporation

Tractor and Machinery Association of Australia

WorkCover New South Wales

Additional interests participating in preparation of Standard:

Roll-over protective structures manufacturers

Falling-object protective structures manufacturers

---

**Review of Australian Standards.** To keep abreast of progress in industry, Australian Standards are subject to periodic review and are kept up to date by the issue of amendments or new editions as necessary. It is important therefore that Standards users ensure that they are in possession of the latest edition, and any amendments thereto.

Full details of all Australian Standards and related publications will be found in the Standards Australia Catalogue of Publications; this information is supplemented each month by the magazine 'The Australian Standard', which subscribing members receive, and which gives details of new publications, new editions and amendments, and of withdrawn Standards.

Suggestions for improvements to Australian Standards, addressed to the head office of Standards Australia, are welcomed. Notification of any inaccuracy or ambiguity found in an Australian Standard should be made without delay in order that the matter may be investigated and appropriate action taken.

---

*This Standard was issued in draft form for comment as DR 96485.*

Australian Standard<sup>®</sup>

---

**Earth-moving machinery—  
Protective structures**

**Part 2: Laboratory tests and  
performance requirements for  
roll-over protective structures**

---

Originated as part of AS 2294—1979.  
Previous edition part of AS 2294—1990.  
Revised and redesignated in part as AS 2294.2—1997.

## PREFACE

This Standard was prepared by the Standards Australia Committee ME/63, Earthmoving Equipment, to supersede, in part, AS 2294—1990, *Earth-moving machinery—Protective structures*.

The objective of this Standard is to provide designers, manufacturers, suppliers, employers and users of earth-moving machinery with specifications covering technical means to minimize the risks to health and safety of employees and others working with or otherwise near earth-moving machinery.

This Standard is identical with and has been reproduced from ISO 3471:1994, *Earth-moving machinery—Roll-over protective structures—Laboratory tests and performance requirements*.

The AS 2294 series now comprises the following:

## AS

- 2294 Earth-moving machinery—Protective structures
- 2294.1 Part 1: General
- 2294.2 Part 2: Laboratory tests and performance requirements for roll-over protective structures (this Standard)
- 2294.3 Part 3: Laboratory tests and performance requirements for falling-object protective structures
- 2294.4 Part 4: Specifications for deflection limiting volume

Statements expressed in mandatory terms in notes to text and tables are deemed to be requirements of this Standard.

As this Standard is reproduced from an International Standard, the following applies:

- (a) Its number appears on the cover and title page while the International Standard number appears only on the cover.
- (b) In the source text, 'this International Standard' should read 'this Australian Standard'.
- (c) A full point substitutes for a comma when referring to a decimal marker.
- (d) References to International Standards should be replaced by references to the following Australian or Joint Australian/New Zealand Standards:

<i>Reference to International Standard</i>		<i>Australian or Joint Australian/New Zealand Standard</i>	
ISO		AS/NZS	
148	Steel—Charpy impact test (V-notch)	—	
898	Mechanical properties of fasteners	4291	Mechanical properties of fasteners —
898-1	Part 1: Bolts, screws and studs	4291.1	Part 1: Bolts, screws and studs
898-2	Part 2: Nuts with specified proof load values—Coarse thread	4291.2	Part 2: Nuts with specified proof load values—Coarse thread
		AS	
3164	Earth-moving machinery— Laboratory evaluations of roll-over and falling object protective structures— Specifications for deflection-limiting volume	2294	Earth-moving machinery— Protective structures
		2294.4	Part 4: Specifications for the deflection-limiting volume
6165	Earth-moving machinery— Basic types—Vocabulary	2951	Earth-moving machinery— Nomenclature
		2951.1	Part 1: Basic types

The term 'normative' has been used in this Standard to define the application of the annex to which it applies. A 'normative' annex is an integral part of a Standard.

## CONTENTS

	<i>Page</i>
1 Scope . . . . .	1
2 Normative references . . . . .	1
3 Definitions . . . . .	1
4 Symbols . . . . .	2
5 Test method and facilities . . . . .	7
6 Test loading procedure . . . . .	15
7 Temperature and material criteria . . . . .	17
8 Acceptance criteria . . . . .	18
9 Labelling of ROPS . . . . .	19
10 Reporting results . . . . .	19
Annex A ROPS test report for ISO 3471 . . . . .	20

## © Copyright — STANDARDS AUSTRALIA

Users of Standards are reminded that copyright subsists in all Standards Australia publications and software. Except where the Copyright Act allows and except where provided for below no publications or software produced by Standards Australia may be reproduced, stored in a retrieval system in any form or transmitted by any means without prior permission in writing from Standards Australia. Permission may be conditional on an appropriate royalty payment. Requests for permission and information on commercial software royalties should be directed to the head office of Standards Australia.

Standards Australia will permit up to 10 percent of the technical content pages of a Standard to be copied for use exclusively in-house by purchasers of the Standard without payment of a royalty or advice to Standards Australia.

Standards Australia will also permit the inclusion of its copyright material in computer software programs for no royalty payment provided such programs are used exclusively in-house by the creators of the programs.

Care should be taken to ensure that material used is from the current edition of the Standard and that it is updated whenever the Standard is amended or revised. The number and date of the Standard should therefore be clearly identified.

The use of material in print form or in computer software programs to be used commercially, with or without payment, or in commercial contracts is subject to the payment of a royalty. This policy may be varied by Standards Australia at any time.



## AUSTRALIAN STANDARD

# Earth-moving machinery—Protective structures

## Part 2:

## Laboratory tests and performance requirements for roll-over protective structures

### 1 Scope

This International Standard establishes a consistent and reproducible means of evaluating the load-carrying characteristics of Roll-Over Protective Structures (ROPS) under static loading, and prescribes performance requirements for a representative specimen under such loading.

It applies to the following seated design operator-controlled machines as defined in ISO 6165:

- crawler tractors and loaders;
- graders;
- wheeled loaders and wheeled tractors and their modified versions used for rolling or compacting, dozer-equipped wheeled tractors, skid-steer loaders and backhoe loaders;
- wheeled industrial tractors;
- the tractor portion (prime mover), of tractor scrapers, water wagons, articulated steer dumpers, bottom-dump wagons, side-dump wagons, rear-dump wagons and towed fifth-wheel attachments;
- rollers and compactors;
- rigid frame dumpers.

### 2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were 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 editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 148:1983, *Steel — Charpy impact test (V-notch)*.

ISO 898-1:1988, *Mechanical properties of fasteners — Part 1: Bolts, screws and studs*.

ISO 898-2:1992, *Mechanical properties of fasteners — Part 2: Nuts with specified proof load values — Coarse thread*.

ISO 3164:1992, *Earth-moving machinery — Laboratory evaluations of roll-over and falling-object protective structures — Specifications for deflection-limiting volume*.

ISO 6165:1987, *Earth-moving machinery — Basic types — Vocabulary*.

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

### 3 Definitions

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

**3.1 wheeled industrial tractor:** Self-propelled machine designed to provide drawbar and/or PTO power to implements for landscaping and site services at earth-moving job sites.

**3.2 roll-over protective structure (ROPS):** System of structural members whose primary purpose is to reduce the possibility of a seat-belted operator