

Australian Standard<sup>®</sup>

**Amusement rides and devices**

**Part 1: Design and construction**

**STANDARDS**  
Australia



This Australian Standard® was prepared by Committee ME-051, Amusement Rides and Devices. It was approved on behalf of the Council of Standards Australia on 9 July 2009. This Standard was published on 31 July 2009.

---

The following are represented on Committee ME-051:

- Australian Amusement Association
  - Australian Amusement Leisure and Recreation Association
  - Australian Chamber of Commerce and Industry
  - Consumers' Federation of Australia
  - Department of Commerce, Worksafe Division, WA
  - Department of Justice and Attorney General, Qld
  - Department of the Premier and Cabinet, SA
  - Engineers Australia
  - Insurance Council of Australia
  - Kidsafe
  - Safety Institute of Australia
  - Showmen's Guild of Australasia
  - Workcover New South Wales
  - Worksafe Victoria
- 

This Standard was issued in draft form for comment as DR 08135.

Standards Australia wishes to acknowledge the participation of the expert individuals that contributed to the development of this Standard through their representation on the Committee and through the public comment period.

---

#### **Keeping Standards up-to-date**

Australian Standards® are living documents that reflect progress in science, technology and systems. To maintain their currency, all Standards are periodically reviewed, and new editions are published. Between editions, amendments may be issued.

Standards may also be withdrawn. It is important that readers assure themselves they are using a current Standard, which should include any amendments that may have been published since the Standard was published.

Detailed information about Australian Standards, drafts, amendments and new projects can be found by visiting [www.standards.org.au](http://www.standards.org.au)

Standards Australia welcomes suggestions for improvements, and encourages readers to notify us immediately of any apparent inaccuracies or ambiguities. Contact us via email at [mail@standards.org.au](mailto:mail@standards.org.au), or write to Standards Australia, GPO Box 476, Sydney, NSW 2001.

---

Australian Standard<sup>®</sup>

**Amusement rides and devices**

**Part 1: Design and construction**

Originally as part of AS 3533—1988.  
Previous edition in part as AS 3533.1—1997 and AS 3533.1 Supp1—2003.  
Revised, amalgamated and designated as AS 3533.1—2009.  
Reissued incorporating Amendment No. 1 (December 2011).

**COPYRIGHT**

© Standards Australia Limited

All rights are reserved. No part of this work may be reproduced or copied in any form or by any means, electronic or mechanical, including photocopying, without the written permission of the publisher, unless otherwise permitted under the Copyright Act 1968.

Published by SAI Global Limited under licence from Standards Australia Limited, GPO Box 476, Sydney, NSW 2001, Australia

ISBN 0 7337 9204 9

## PREFACE

This Standard was prepared by Joint Standards Australia/Standards New Zealand Committee ME-051, Amusement Rides and Devices, to supersede AS 3533.1—1997 and AS 3533.1 Suppl—2003.

*This Standard incorporates Amendment No. 1 (December 2011). The changes required by the Amendment are indicated in the text by a marginal bar and amendment number against the clause, note, table, figure or part thereof affected.*

This Standard was prepared by the Australian members of the Joint Standards Australia/Standards New Zealand Committee, ME-051. After consultation with stakeholders in both countries, Standards Australia and Standards New Zealand decided to develop this Standard as an Australian Standard rather than an Australian/New Zealand Standard.

The objective of this Standard is to provide regulators, designers and manufacturers with requirements for the design and construction of amusement rides and devices to promote uniformity with regards to design principles, manufacture and registration of these devices.

Originally developed from technical literature, existing regulations and guidelines, this Standard has been developed through the combined experience of the Committee and the organizations represented on it, along with contributions from several individuals and organizations having expert knowledge in those areas covered by this Standard.

The Committee acknowledges the contributions made by those individuals and organizations and by the Royal Australian Air Force on the subject of the influence of acceleration on the human body (Appendix D), and wishes to record its appreciation of their permission to include this material.

Major changes to the previous edition are as follows:

- (a) Clarification of requirements for calculating the acceleration factor in Clause 2.1.4.
- (b) Clarification of when to assess a ride for intrinsic safety and inclusion of the text from AS 3533.1 Suppl—2003 as Appendix E, providing guidance on determining if a ride's intrinsic safety is secured or not secured.
- (c) Revision of requirements relating to loads and the basis of design to address both permissible stress design and ultimate limit state design methodologies.
- (d) Expansion of requirements for passenger restraints to include a risk assessment process.
- (e) Revision of requirements for land-based toboggans with respect to automatic speed controls and safety zones around the channel.
- (f) Relocation of specific requirements for inflatable structures and roller coasters to separate Standards.
- (g) Removal of passenger ropeways and passenger conveyors from the scope of AS 3533.1.

The Committee also intends to refer to a new Standard for flying foxes that is under preparation by Committee SF-047, Artificial Climbing Structures, to replace the requirements in Clause 5.12. When the new Standard is published, this Standard will be amended accordingly.

Attention is drawn to AS 3533.2, which is written specifically for owners and operators involved in the day-to-day running of amusement rides and devices.

The term 'informative' has been used in this Standard to define the application of the appendix to which it applies. An 'informative' appendix is only for information and guidance.

## CONTENTS

	<i>Page</i>
SECTION 1 SCOPE AND GENERAL	
1.1 SCOPE.....	5
1.2 REFERENCED DOCUMENTS.....	5
1.3 DEFINITIONS.....	9
SECTION 2 DESIGN	
2.1 CLASSIFICATION .....	12
2.2 HAZARD IDENTIFICATION, RISK ASSESSMENT AND CONTROL OF RISK.....	14
2.3 LOADS.....	14
2.4 BASIS OF DESIGN.....	22
2.5 STABILITY.....	27
2.6 STRUCTURAL MATERIALS .....	27
2.7 ANCILLARY MATERIALS .....	30
2.8 CONTAINMENT AND RESTRAINTS .....	30
2.9 FACILITIES FOR OPERATORS AND ATTENDANTS.....	42
2.10 BRAKING.....	42
2.11 ELEVATING MECHANISMS.....	43
2.12 RIDES AND DEVICES WITHIN BUILDINGS.....	45
2.13 PROTECTION FROM FIRE AND FUMES.....	46
SECTION 3 MANUFACTURE AND CONSTRUCTION	
3.1 QUALITY ASSURANCE .....	47
3.2 VEHICLE FINISH AND IDENTIFICATION .....	47
3.3 PROPELLING MACHINERY.....	47
3.4 LIGHTNING PROTECTION .....	48
3.5 COMBUSTIBILITY OF MATERIALS.....	49
3.6 HYDRAULIC EQUIPMENT.....	50
3.7 PNEUMATIC EQUIPMENT.....	52
3.8 STEAM, HOT WATER AND HEATED AIR EQUIPMENT.....	53
3.9 ELECTRICAL REQUIREMENTS .....	55
3.10 CONTROLS AND INDICATORS .....	57
3.11 OPERATOR CONTROL STATIONS .....	58
3.12 SUSPENDED VEHICLES AND SUSPENSION JOINTS.....	59
3.13 SUSPENSION ROPES AND CHAINS .....	59
3.14 FENCES, HANDRAILS, GUARDS AND TEMPORARY BARRIERS.....	59
3.15 ENTRY AND EXIT GATES AND CONTROLS .....	60
3.16 WALKWAYS, STEPS AND PLATFORMS .....	61
3.17 CLEARANCES .....	61
3.18 WALK-THROUGH AMUSEMENTS .....	66
3.19 EVACUATION .....	66
SECTION 4 TESTING	
4.1 GENERAL.....	67
4.2 LOAD TEST.....	67
4.3 OUT-OF-BALANCE TEST.....	67
4.4 HYDRAULIC OR PNEUMATIC SYSTEM TEST .....	67
4.5 ELECTRICAL TEST.....	68
4.6 CERTIFICATION .....	68
4.7 DEVICE REGISTRATION AND LOGGING OF TESTS.....	68

## SECTION 5 SPECIFIC REQUIREMENTS

5.1	GENERAL.....	69
5.2	AQUATIC AMUSEMENT DEVICES .....	69
5.3	WATERBORNE RIDES.....	71
5.4	COIN-OPERATED AMUSEMENT DEVICES.....	73
5.5	DODGEM CARS.....	74
5.6	'Text deleted'.....	74
5.7	FERRARI 500-TYPE KARTS AND TRACKS .....	74
5.8	TOBOGGANS (LAND-BASED) .....	76
5.9	TRAINS.....	78
5.10	AMUSEMENT DEVICES INCORPORATING ELASTIC SUSPENSION SYSTEMS .....	82
5.11	AIR-CUSHIONED VEHICLES.....	83
5.12	FLYING FOXES .....	85
5.13	PARASAILING.....	87
5.14	CABLE WATERSKIING.....	88
5.15	MINI BIKES AND MINI BIKE TRACKS .....	89
5.16	DRY SLIDES .....	90

## SECTION 6 INFORMATION

6.1	INSTRUCTIONS.....	91
6.2	DATA.....	91

## SECTION 7 MARKING

7.1	GENERAL.....	92
7.2	IDENTIFICATION PLATE.....	92
7.3	ADDITIONAL INFORMATION .....	92

## APPENDICES

A	STATUTORY REQUIREMENTS.....	93
B	SUGGESTED TRAINING, QUALIFICATIONS AND EXPERIENCE FOR COMPETENT PERSONS .....	96
C	FAILURE TO SAFETY (FAIL-SAFE SYSTEMS).....	98
D	BASIC FACTS ON THE EFFECTS OF ACCELERATION ON THE HUMAN BODY.....	100
E	GUIDANCE ON ASSESSING INTRINSIC SAFETY .....	104
F	GUIDELINES FOR THE DESIGN AND ANALYSIS OF AMUSEMENT RIDES AND DEVICES SUBJECT TO FATIGUE.....	109
G	GUIDANCE ON RISK ASSESSMENTS CONCERNING PROVISION OF FAULT TOLERANT CONTAINMENT AND RESTRAINT SYSTEMS.....	111
H	PROVISIONS AND CRITERIA FOR EXITS .....	115
I	RELATIONSHIP BETWEEN CABLE ANGLE AND CABLE TENSION UNDER VARYING LOADS FOR A FLYING FOX INSTALLATION .....	116

## STANDARDS AUSTRALIA

### Australian Standard Amusement rides and devices

#### Part 1: Design and construction

## SECTION 1 SCOPE AND GENERAL

### 1.1 SCOPE

This Standard specifies requirements for the design, manufacture and construction of fixed and portable amusement rides and devices, excluding—

- (a) miniature trains and railway systems owned and operated by model railway societies, clubs or associations;
- (b) rides or devices when operated under the control of public transport legislation;
- (c) plant specifically designed and used for sporting, professional stunt, theatrical or acrobatic activities; and
- (d) passenger ropeways and passenger conveyors (see AS 1722).

#### NOTES:

- 1 The exclusion in Item (c) does not prevent such plant being used as an amusement device provided it complies with the relevant requirements in this Standard.
- 2 Specific requirements for particular types of amusement rides and devices are specified in Section 5 of this Standard, other Parts of AS 3533 and other Standards; the specific requirements take precedence over corresponding general requirements in this Standard where any difference exists. Clause 5.1 lists the other Parts of AS 3533 and the other Standards that will need to be consulted for certain types of amusement rides and devices.
- 3 The operation and maintenance of amusement rides and devices are covered by AS 3533.2. AS 3533.3 provides requirements for in-service inspections of amusement rides and devices.
- 4 Compliance with the requirements and conditions set down by associations such as The Australian Association of Live Steamers is generally required for the miniature trains and railway systems mentioned in Item (a) above.

### 1.2 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS	
1056	Storage water heaters
1056.1	Part 1: General requirements
1056.2	Part 2: Specific requirements for water heaters with single shells
1056.3	Part 3: Specific requirements for water heaters with composite shells
1170	Structural design actions
1170.4	Part 4: Earthquake actions in Australia
1210	Pressure vessels
1210 Suppl	Unfired Pressure Vessels—Advanced design and construction (Supplement to AS 1210—1997)
1228	Pressure equipment—Boilers