

Interim Australian Standard[®]

Amusement rides and devices

Part 4.5: Specific requirements— Waterborne inflatables



This Interim Australian Standard® was prepared by Committee ME-051, Amusement Rides and Devices. It was approved on behalf of the Council of Standards Australia on 19 July 2012.

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- Australian Amusement Association
 - Australian Amusement Leisure and Recreation Association
 - 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
 - Kidsafe
 - University of Technology, Sydney
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-

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Part 4.5: Specific requirements— Waterborne inflatables

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PREFACE

This Interim Standard was prepared by Standards Australia Committee ME-051, Amusement Rides and Devices. It was prepared to provide an Interim Standard that addressed the design and operation of waterborne inflatable (WBI) equipment and facilities.

This Standard incorporates Amendment No. 1 (April 2015). 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.

The objective of this Interim Standard is to provide designers, manufacturers, proprietors and operating staff with requirements and guidance specific to the design, construction, operation and maintenance of waterborne inflatable equipment and facilities that will protect health and safety of both operating staff and patrons of these devices.

This Interim Standard is part of a series designed to cover aspects of safety for amusement rides and devices. Parts 1 and 2 deal with the general aspects of safety common to all kinds of amusement rides and devices and are intended to be used in conjunction with the specific requirements for the particular type of ride. While some ride-specific requirements have been included in Parts 1 and 2, these are now being progressively moved into individual Standards in a new AS 3533.4 series. Parts in the AS 3533.4 series relate to particular rides or devices and give requirements and guidance tailored to the particular kinds of hazards relevant for that ride or device.

In the development of this Interim Standard, reference was made to EN 15649-1:2009. *Floating leisure articles for use on and in the water, Part 1: Classification materials, general requirements and test methods.*

Attention is drawn to the fact that this document is an Interim Australian Standard and should be regarded as a developmental Standard and liable to future alteration.

This Interim Standard will have a currency of two years from its date of publication. At the conclusion of that period it will be superseded by another Standard, confirmed as an interim Standard in its present form for a further two year period or withdrawn.

It should be noted that compliance with this Interim Standard alone does not necessarily ensure that all legal obligations are being fulfilled.

The terms ‘normative’ and ‘informative’ have been used in this Interim Standard to define the application of the appendix to which they apply. A ‘normative’ appendix is an integral part of a Standard, whereas an ‘informative’ appendix is only for information and guidance.

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FOREWORD

At present, various persons have been assigned a duty of care in the Work Health and Safety (WHS) legislation in Australia.

This Foreword indicates how these duties can generally be interpreted and may provide an understanding of the basis for the requirements in this Interim Standard.

Under WHS legislation, persons conducting a business or undertaking have a duty to ensure the safety of their workers and other people at the workplace. The operator of a waterborne inflatable (WBI) therefore has a duty to ensure that participants and others present are not exposed to risks arising from the activities. This duty includes, as far as reasonably practicable, providing a safe and healthy work environment, safe plant and structures, safe systems of work and any information, training, instruction or supervision as necessary to protect persons from the conduct of the facility and its operation.

Persons conducting a business or undertaking also have a duty to consult with workers, not just employees, who carry out work for the business or undertaking who are, or are likely to be, directly affected by a matter relating to work health or safety.

Designers, manufacturers and suppliers of plant and structures also have duties to ensure, so far as is reasonably practicable, the plant (or structure) is safe and without risk when used for a purpose for which it was designed and manufactured. Additionally they need to provide information on the purpose and any conditions necessary to ensure it is safe when used, including maintenance and repair.

There are specific requirements for installation of plant (e.g. each setup of a waterborne inflatable) to include an inspection and for identified risks to be controlled.

While this is a broad summary of the applicable legislation, readers should make themselves aware of the legislation in their jurisdiction.

Details on sealed inflatables have NOT been included in this Interim Standard.

Such information will be developed later when the final Standard is developed.

STANDARDS AUSTRALIA

Australian Standard

Amusement rides and devices

Part 4.5: Specific requirements—Waterborne inflatables

1 SCOPE

This Interim Standard specifies safety requirements and test methods related to materials, safety, performance, operation and management of constant airflow inflatable devices when used as amusement devices on controlled water. It also specifies information to be supplied with the equipment.

NOTE: The next edition of this Interim Standard is intended to also include sealed inflatable devices other than aquatic toys, e.g. blow up rings, inflated seahorses, rings intended for use on water slides, flotation aids for water familiarization.

2 REFERENCED DOCUMENTS

The following documents are referred to in this Interim Standard:

AS

- 3533 Amusement rides and devices
- 3533.1 Part 1: Design and construction
- 3533.2 Part 2: Operation and maintenance
- 3533.3 Part 3: In-service inspection
- 4685 Playground equipment
- 4685.1 Part 1: General safety requirements and test methods
- 4878 Methods of test for coated fabrics
- 4878.6 Part 6: Determination of tensile strength and elongation at break

AS/NZS

- 4422 Playground surfacing—Specifications, requirements and test methods

ISO

- 2231 Rubber- or plastics-coated fabrics—Standard atmospheres for conditioning and testing
- 4674 Rubber-or plastics-coated fabrics—Determination of tear resistance
- 4674-1 Part 1: Constant rate of tear methods
- 15025 Protective clothing—Protection against heat and flame—Method of test for limited flame spread

BS

- 3408 Specification for tarpaulins
- 5438 Methods of test for flammability of textile fabrics when subjected to a small igniting flame applied to the face or bottom edge of vertically oriented specimens

EN

- 15649 Floating leisure articles for use on and in the water
- 15649-6 Part 6: Additional specific safety requirements and test methods for Class D devices

3 DEFINITIONS

For the purpose of this Interim Standard, the definitions below apply.

NOTE: In order to allow freedom of design for the manufacture of new equipment, only the fundamental forms of equipment and motion are defined, rather than confining the Interim Standard to equipment currently in use.

3.1 Blower

A powered fan used to inflate the device.

3.2 Competent person

A person who has acquired through training, qualifications or experience, or a combination of these, the knowledge and skills enabling that person to perform a specified task.

3.3 Continuous air flow inflatable

An inflatable structure or device that relies on a continuous supply of air pressure to maintain its shape.

3.4 Controlled water

Constructed waters (e.g. pools and artificial waterways) and limited defined areas of natural water (e.g. roped off areas or where devices are tethered to prevent movement beyond the limited area).

3.5 Critical fall height

The upper limit of all free heights of fall, for which the surface provides adequate levels of impact attenuation.

3.6 Depth of water

The distance from the surface of the water surrounding the inflatable device to the highest underwater obstruction, in the potential fall zone, for patrons using the device.

3.7 Designated operating position

The position of the WBI that maintains clearances from pool edges and maintains required depth of water under the unit.

3.8 Free height of fall

The greatest distance from the clearly intended body support, when measured in the unloaded but inflated state, to the water level below, minus 5%.

NOTE: This 5% takes into account the lowering of the body support under load.

3.9 Inflatable structure or device

A device fabricated from flexible materials that relies on internal air pressure to maintain its shape.

3.10 Non-slip matting

A non-slip energy attenuating mat to minimize injury in the event of a fall while entering a WBI from the pool edge.

3.11 Open side

Any external side of an inflatable with no containment wall.

3.12 Platform

Any surface on which a patron may stand or traverse.

3.13 Playing area

Any part or area of the device that is used by patrons solely for the purpose of taking part in the activity for which the device is designed.

3.14 Ramp

An inclined section aiding the access and egress of patrons into and out of the playing area of the inflatable, making the transition between the height of the playing area and the pool surround.

3.15 Step

A section of intermediate height aiding the access and egress of patrons into and out of the playing area of the inflatable, making the transition between the height of the playing area and the pool surround.

3.16 Swimming ability (proof of)

This proof may take the form of a swimming certificate or a swimming test conducted by a competent person, prior to entry to the inflatable.

3.17 Toy

A play item that, when attached to the playing area, forms part of the inflatable device.

3.18 Waterborne inflatable (WBI)

An inflatable used on controlled water.

4 CONTINUOUS AIR FLOW INFLATABLES

4.1 Methods of construction and materials

4.1.1 *Methods of construction*

There shall be no hard or sharp angles or edges in any part of the waterborne inflatable (WBI) device that is accessible to patrons. Such items include outside seams with a raw edge, square inflated corners and sharp pointed cones.

Patrons shall not be able to come into contact with any hard object placed inside or adjacent to the WBI when in use or during unintended deflation.

Any hard object positioned over the playing area and supported by air pressure should have an additional support system independent of air pressure.

Joints and seams in those parts of the device that are subject to force and stress applied by patrons or are part of the load path of anchorage systems shall be made so they achieve no less than the minimum tensile strength of the fabric used in those parts. These joints and seams shall be capable of inspection during the life of the device to check their integrity.

4.1.2 *Fabrics*

4.1.2.1 *Strength*

Fabrics shall be of adequate tear and tensile strength for the weight of the intended users and have sufficient air retention abilities to enable the WBI, when pressurized to the levels specified in the operation manual, to resume its intended shape after distortion under load. Fabrics used in those parts of the WBI that are subject to force or stress as applied by the patrons or the anchorage system shall have the following minimum strengths after conditioning in Atmosphere C using Method 1 of ISO 2231:

- (a) Minimum tear strength of 400 N warp and 350 N weft when tested in accordance with Method A of ISO 4674-1.
- (b) Minimum tensile strength of 2250 N warp and 2250 N weft when tested in accordance with AS 4878.6.

Lower strength fabrics may be used in decorative parts that do not come into contact with patrons. Such fabrics shall be of adequate tear and tensile strength to withstand the design operating pressure.

NOTE: Cold flex cracking and surface coating adhesion are both measurable parameters that should be considered by the designer as they affect performance of the fabric.

4.1.2.2 *Flammability*

Coated fabrics used in or attached to a WBI shall be tested in accordance with the surface ignition test (Procedure A) in ISO 15025 and shall comply with either of the pass criteria for flammability performance as specified in BS 3408:1992.

NOTE: BS 3408:1992 specifies test 2A of BS 5438 as the test method for determining the flammability of PVC-coated fabrics, however ISO 15025 has superseded this test method and is therefore specified.

4.1.3 *Thread*

Thread used in joints and seams shall be of non-rotting yarn such as polyester or nylon and be of at least 88 N tensile strength.

4.1.4 *Netting or mesh*

No form of netting or mesh shall be used as containment on any WBI.

4.1.5 *Clamber nets*

Clamber nets shall be securely attached to the WBI to prevent lifting by the patrons. When nets are made from rope, the rope shall be a minimum of 16 mm diameter and securely knotted at intersections. When nets are made from webbing, the webbing shall be 50 mm × 2 mm on a 400 mm square grid opening, securely stitched at intersections. Clamber nets shall comply with AS 4685.1.

4.1.6 *Climbing ropes*

Climbing ropes shall be fixed at both ends in such a way as to prevent the possibility of entrapment.

4.1.7 *Zips*

Zips shall withstand the air pressure generated within the device. Zips used for deflation purposes shall have the puller hidden from view (e.g. by a flap or pocket).

4.1.8 *Paint or other decorative substances*

Paint or other decorative substances shall be non-toxic and non-flammable.

5 ANCHORAGE

5.1 *Number of anchorage points*

Sufficient anchorage points shall be provided and located such as to enable stability and restraint to be maintained within the designer's stated operating conditions.

The wind speed, for which WBIs shall be designed, for external use, shall be not less than 11.1 m/s (40 km/h). Manufacturers may specify a lower wind speed for operational purposes, even though the unit is designed for 11.1 m/s wind speed.

NOTE: The Beaufort Scale is shown in Appendix A.

The number of anchorage points to address wind loads shall be calculated in accordance with Appendix B.

WBIs used in pools located within buildings shall use sufficient anchorage points to enable stability and restraint under the designer's stated operating conditions.

5.2 Anchorage systems

5.2.1 External use (*exposed to wind*)

The following requirements apply:

- (a) Where the WBI is required to withstand wind pressure, each anchorage point on the WBI and on the pool edge shall withstand a minimum horizontal force of 1.6 kN (160 kgf) and shall be tested as such.
- (b) Each anchorage rope or strap and associated fittings shall have a minimum breaking load of 8 kN.
- (c) Anchorage ropes and/or straps that may be fallen on shall be braided polyester, UV protected, smooth, padded where necessary, brightly coloured and incorporate an expansion piece to allow some flexibility. The expansion piece shall be installed in parallel with the anchor rope for a sufficient length such that after maximum 500 mm of stretch the anchor rope takes the full load with no further stretch.
- (d) WBIs with an entry point from the edge of the pool shall not include an expansion piece in the anchorage at the entry point.
- (e) The anchorage system shall be designed so that the anchor ropes or straps, incorporating an expansion piece where required, are secured in a manner that prevents the device lifting off the water or moving from the designated operating position.

NOTE: Expansion piece should have a maximum stretch of 500 mm and a minimum breaking load of 0.25 kN (25 kgf).

- (f) Anchorage systems shall incorporate attachment methods that follow recognized rigging practice.

NOTE: Anchor ropes should be sufficiently in tension to hold the device in the designated operating position during use.

5.2.2 Internal use (*not exposed to wind*)

The following requirements apply:

- (a) Anchorage ropes and/or straps that may be fallen on shall be braided polyester, UV protected, smooth, padded where necessary, brightly coloured and incorporate an expansion piece to allow some flexibility.
- (b) WBIs with an entry point from the edge of the pool shall not include an expansion piece in the anchorage at the entry point.
- (c) The anchorage system shall be designed so that the anchor ropes or straps, incorporating an expansion piece where required, are secured in a manner that prevents the device lifting off the water or moving from the designated operating position.

NOTE: Expansion piece should have a maximum stretch of 500 mm and a minimum breaking load of 0.25 kN (25 kgf).

- (d) Anchorage systems shall incorporate attachment methods that follow recognized rigging practice.

NOTE: Anchor ropes should be sufficiently in tension to hold the device in the designated operating position during use.

6 STRUCTURAL INTEGRITY

6.1 Air pressure

The minimum air pressure inside the device shall in all cases be sufficient to give a firm and reliable footing and adequately support the superstructure.

Playing areas, platforms, steps and ramps shall support the weight of the largest (heaviest) user for whom the WBI is designed without sinking or showing excessive deformation. When tested in accordance with the method in Appendix C, the appropriate weight shall remain supported by the WBI at each test point.

Containing walls and towers shall be strong enough to contain the largest user for whom the WBI is designed.

The WBI shall support itself and any attachments included in the design under recommended operational load conditions.

6.2 Support

The design of a WBI shall ensure that, upon loss of air pressure, the device remains afloat with sufficient clearances and for adequate time—

- (a) to enable all patrons to evacuate, and for the operator to ensure that the device is clear; or
- (b) for action to be taken to restore inflation before there is a danger of entrapment of any patron.

NOTE: An independent support system may be used.

To minimize the risk of entrapment in an unintended collapse of the structure, through failure of the blower or power supply, the WBI should include within the air supply system an effective means to prevent backflow of inflation air. Such means shall maintain sufficient air within the device to prevent sudden deflation.

WBIs shall be designed to ensure adults are able to gain access in order to assist patrons during emergency evacuation.

7 OPEN SIDES, ACCESS AND EGRESS

On any open side of the WBI, except a side used for direct access from or egress to the pool edge, the depth of water available shall be as calculated as per Clause 9.

On any side of the WBI from which a patron may fall, except a side used for direct access from or egress to the pool edge, the distance to the pool edge or other solid object shall be no less than the maximum height of the WBI platform from where a fall may occur, or 2 m whichever is greater.

On any open side where patrons may swing away from the WBI, such as via a Tarzan rope, the distance to the pool edge or other solid object shall be not less than 2.5 times total length of the swing rope, or 3 m whichever is greater.

The exit from a WBI slide shall have a clear horizontal distance over water of 2 m minimum or twice the height of the slide, to a maximum of 6 m and be into water of minimum depth calculated as per Clause 9.

For open sides used for direct access from or egress to a pool edge, non-slip matting shall be placed at that side on the pool edge surface. The non-slip matting shall, where possible, extend a distance of at least 900 mm laterally and 1200 mm axially on the pool edge surface beyond the limits of the entry point. The matting shall include a turn down into the pool of at least 100 mm to protect against impact with the actual pool edge.