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National Standard of the People's Republic of China

GB/T 18168-2017

Replaced GB/T 18168-2008

水上游乐设施通用技术条件

Specifications of water amusement equipment category

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Foreword

This standard was drafted according to the rules given in GB/T 1.1 – 2009

This standard replaced GB/T 18168-2008 Specifications of water amusement equipment category.

Compared with GB 18168-2008, the main changes are as follows:

a) Part of terminologies are revised and increased, and classification of terminologies is reorganized and arranged; the total number of terminologies is increased from 34 specified in the original standard to 53 (see Chapter 3)

b) Modified most contents of the technical requirements (see Chapter 4);

1) Modified and deleted partial contents of "basic requirements" (see 4.1).

2) The basic specifications for design are deleted and its partial contents are listed to other relevant provisions of this chapter (see Chapter 4).

3) The order of "amusement pool" and "water slide device" has been revised (see 4.2, 4.3).

4) The main revisions of the "water slide device" are as follows:

-The "water slide device" clauses after revision are divided into three ones, "material", design" and "safety technical requirements" (see 4.2);

-For the "material" after revision, general requirements for material are increased, and supporting structure is specified, and basic requirements are also stipulated. (see 4.2.1);

-The "design" after revision is newly increased contents, the contents that shall be included for design calculation as well as the basis of fetching the value of design load are mainly specified, and the calculation example of centrifugal force (inertia

-For the "safety technical requirements" after revision, some contents in the original standard are revised and included in the clause, and new contents are increased accordingly (see 4.2.3).

5) Part of contents of "recreation pools" are revised, and the "waving equipment" is revised to "waving pools" and included in "4.3 recreation pools" (see 4.3).

6) The "interactive amusement ride" is revised to "water attraction complex", and part of contents are revised and increased (see 4.4).

7) Modified and deleted partial contents of "whitewater rafting" (see 4.5).

8) Modified partial contents of "pleasure boats" (see 4.6).

c) The "test method" was revised. The "test conditions" and "water slide device test" were mainly revised (see Chapter 5).

d) The "inspection rules" have been revised. The main contents of revision are as follows: (see Chapter sixth):

1) The classification of inspection and sampling inspection are deleted, and it is specified that the inspection is one hundred percent inspection (see 6.1.1).

2) The form of list is used to specify the items, basis and methods of general test and special test for various Categories of equipment and facilities (see 6.1.2)

e) The "Annex" was revised. The main revisions are as follows:

Changed Annex A to Annex B (informative) and the contents of Annex B are modified.

Annex A (Informative) has been added.

This standard is under the jurisdiction of National Technical Committee(SAC/TC 250) of Standardization for Ropeways and Amusement Equipments.

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Issuing of previous versions of the standard is as follows:

——GB 18168—2000, GB/T 18168—2008.

Specifications of water amusement equipment category

1 Scope

This standard specifies the terms and definitions, technical requirements, test methods and inspection rules of water amusement equipment.

This standard is applicable to water amusement equipment such as water slide device, amusement pool, interactive aquatic play structure, whitewater rafting and pleasure boats.

This standard is not applicable to boats with more than 6 riders which are operated by special person and inflatable water slide devices.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

GB/T 153 Coniferous sawn timber

GB/T 1447 Fiber-reinforced Plastics Composites - Determination of Tensile Properties

GB/T 1449 Fiber-reinforced Plastic Composites - Determination of Flexural Properties

GB/T 1451 Fiber-reinforced Plastics Composites - Determination of Charpy Impact Properties

GB/T 1462 Test Methods for Water Absorption of Fiber Reinforced Plastics

GB/T 1804 General Tolerances - Tolerances for Linear and Angular Dimensions without Individual Tolerance Indications

GB/T 2577 Test Method for Resin Content of Glass Fiber Reinforced Plastics

GB 2894 Safety Signs and Guideline for the Use

GB 3096 Environmental Quality Standards for Noise

GB/T 7403.1 Lead-acid Traction Batteries - Part 1: Technical Specification

GB 8408 Amusement Device Safety Code

GB 9667 Hygienic Standard for Swimming Place

GB/T 13912 Metallic Coatings - Hot Dip Galvanized Coatings on Fabricated Iron and Steel Articles - Specifications and Test Methods

GB/T 20306-2006 Amusement Devices Terminology

GB/T 34370.2 Nondestructive Testing of Amusement Equipment - Part 2: Visual Examination

GB/T 34370.3 Nondestructive Testing of Pressure Equipment - Part 3: Magnetic Particle Testing

GB/T 34370.1 Nondestructive Testing of Pressure Equipment - Part 4: Penetrant Testing

GB 50205 Code for Acceptance of Construction Quality of Steel Structures

GB 50755 Code for construction of steel structures

CJ 244 Water Quality Standards for Swimming Pools

CJJ 122 Technical Specification for Water Supply and Drainage Engineering of Swimming Pool

3 Terms and definitions

For the purposes of this document, the terms and definitions given in GB/T 20306-2006 and the following apply. For the convenience of application, relevant terms and definitions specified in GB/T 20306-2006 are listed below.

3.1 water amusement equipment

amusement equipment constructed by virtue of water area, water flow or other carriers for entertainment purpose.

Note 1: The water amusement equipment include water slide device, amusement pool (such as rafting River, waving pools, etc.), interactive aquatic play structure, whitewater rafting and pleasure boats.

Note 2: Rewrite GB/T 20306-2013, definition 2.3.

3.2

large-scale water amusement equipment

The water amusement ride available for riders to enjoy the pleasure for the purpose of operation, its maximum running linear velocity is designed to be more than or equal to 2 m/s, or its running height is more than or equals to 2 m.

3.3

water slide device

The amusement ride that is composed of water slide, structural support, water-circulation system, starting platform, catch unit (or splashdown area) and slide raft as well as others and that is supplied to riders to slide along inner surface of summer toboggan run with water as lubricating medium.

Note: Rewrite GB/T 20306-2013, definition 5.8.18.

3.3.1

water slide

Trough and conduit and so on available for riders to slide in water slide device.

3.3.1.1

starting position

The area where riders enter water slide and prepare to slide.

3.3.1.2

slide proper

The area where riders slide along specific surface of summer toboggan run

3.3.1.3

final part

The part available for riders to touch down and finish the slide at the end of water slide, including subsequent catch unit and splashdown area.

3.3.2

structural supports

The structure used to support water slide.

3.3.3

water-circulation system

The assembly that is composed of water pump, circulating water supply pipe and its accessories, electrical control device and others and provides the water with lubrication function or auxiliary propulsion function for water slide device.

3.3.4

starting platform

The passage or area before starting position of water slide.

3.3.5

catch unit

The part available for riders to stop sliding at the end of water slide.

3.3.6

splashdown area

The special or common water pool available for riders to slide down and buffer and stop sliding at the end of water slide.

3.3.7

slide vehicle

The device used by riders to slide on the inner surface of water slide.

3.3.7.1

water slide tube or raft

The inflatable slide raft available for riders to slide on the inner surface of water slide.

3.3.7.2

water slide mat

The slide raft available for riders to slide on the inner surface of water slide, generally being made of plastic cement or air foam cushion and other materials.

3.3.8

tube or raft hoister

The special device used to lift and deliver slide raft.

3.3.9

straight slide

The slide that the horizontal projection of longitudinal centerline of summer toboggan run is straight.

Note : Rewrite GB/T 20306-2013, definition 5.8.21.

3.3.10

curve slide

The slide that the horizontal projection of longitudinal centerline of summer toboggan run is curve.

Note: Rewrite GB/T 20306-2013, definition 5.8.22.

3.3.11

enclosed water slide

The slide that the cross section of summer toboggan run is enclosed curve.

3.3.12

open water slide

The slide that the cross section of summer toboggan run is unenclosed curve.

3.3.13

body water slide

The slide that riders slide through body contact with the surface of summer toboggan run.

3.3.15

mat sliding water slide

The water slide device that riders use water slide mat to slide.

3.3.16

children's water slide

The water slide device only used for children.

3.3.17

speed slide

The water slide device with the maximum slide speed being more than 8 m/s, but less than or equaling to 16 m/s.

3.3.18

high speed slide

The water slide device with the maximum slide speed being more than 16 m/s.

3.3.19

special water slide

Other slides except for straight slide and curve slide.

Note: typical product series include big trumpet, boomerang water slide device (waving), water roller coaster (water dragon), behemoth bowl (vortex) and other water slide devices.

3.3.20

slide average inclination

The result obtained after the height difference between starting position and ending part of water slide (height of water slide device) is divided by the spread length of longitudinal centerline of water slide, being expressed with percentage.

3.3.21

rider mechanical release device

The mechanical device or facility that can delivery riders to slide zone.

Note: typical products include belt conveyor and roller conveyor and others.

3.3.22

water slide device attendant

The working personnel who are responsible for ushering, guiding and delivering riders, and controlling them to enter into and leave from water slide and other equipment or facility.

3.3.23

water flow

The water volume flowing through water slide within unit time to ensure smooth slide of riders.

Note: Rewrite GB/T 20306-2013, definition 5.8.19.

3.3.24

clearance zone

The barrier-free safety space around riders within slide zone

3.3.25

down~slide way sign

The graphic mark that guides riders to slide according to regulated down-slide pose.

Note: Rewrite GB/T 20306-2013, definition 5.8.20.

3.4

pool edge

The area higher than water surface and with certain breadth around recreation pools.

[GB/T 20306-2013, definition 5.8.10]

3.5

waving pools

The water pool that is forced to generate waves by waving equipment.

[GB/T 20306-2013, definition 5.8.2]

3.5.1

wave height

The height difference between wave peak and wave valley

3.5.2

waving equipment

The device used to generate waves in waving pool and surfing pool and relevant special training pool of water park and other water bodies.

3.5.3

game wave

The wave used for public pleasure.

3.5.4

wave in a greater degree

The wave used for surfing performance and surfing recreation enjoyed by riders.

3.6

interactive aquatic play structure

The water amusement ride combined by several kinds of water game facilities and water slide devices.

3.7

whitewater rafting

The whole set of facility that riders take the drifting boat lifted to certain height by lifting device to slide along specific artificial watercourse under the driving force of specific water circulation system.

3.8

pleasure boats

The general term of various boats available for riders to enjoy the pleasure and visit

Note: Rewrite GB/T 20306-2013, definition 5.8.28.

3.8.1

catamaran

The boat whose hull is composed of two demihulls on the right and left.

3.8.2

total length of pleasure boats

The distance from the eyes of the stem post to the back side of the stern trimming flap under the state of being parallel to the static load waterline.

3.8.3

beam

The maximum breadth between outer surfaces on the two sides of hull, excluding fenderbeam and other protrusions.

3.8.4

ship velocity

The sustained maximum route speed at full load.

Note: in m/s.

3.8.5

outboard motor

The small-scale propulsion device that is composed of power machine, propeller, shaft or rudder and is hung at stern

3.8.6

hull static strength loading test

The test for internal and external actions resistance of hull structure under the static load as required.

3.8.7

hull water proof test

The test for penetration resistance of hull structure performed as required.

3.8.8

pleasure boats stability test

The performance test for external force (or shift weight) resistance of leisure boat for recovery of its original equilibrium position performed as required.

3.9

rider

Any person who is entering into, using and leaving from water amusement ride.

3.10

instructional signage

The information signage that is arranged at the entrance of amusement ride and within the range of public visibility to inform riders of proper using methods, riding pose and their behavior requirements and other information.

3.11

safety sign

The safety information signage that is arranged at the entrance of amusement ride and within the range of public visibility to inform riders of relevant restriction, warning and guidance and other information.

4 Technical requirements

4.1 Basic Requirements

4.1.1 The design, manufacture, installation, alteration, repair, test and inspection of water amusement equipment should be in accordance with in accordance with the relevant provisions of GB 8408.

The design of water amusement equipment should meet the following requirements:

- a) For large-scale water amusement ride, complete design instructions, calculation sheet, installation and use and maintenance instructions, safety analysis and risk appraisal report, design validation test outline and the whole set of design drawings as well as other technical documents shall be available.
- b) Safety analysis and risk appraisal for large-scale water amusement ride shall conform to relevant requirements of GB8408.
- c) Installation and use and maintenance instructions for large-scale water amusement ride

shall at least clearly regulate using conditions, technical parameters, operation procedure, note to riders, requirements for riders, inspection items for test run, items for daily inspection and regular inspection, maintenance items and requirements, common faults and troubleshooting methods, emergent accident treatment plans, design service life of complete machine and main stressed members, test for main stressed members and replacement circle and method for vulnerable parts and so on.

d) Design documents shall specify the critical welds, shaft and pin involved in personal safety and their technical requirements.

e) The selection of standard electromechanical products shall be reasonable while non-standard electromechanical products shall satisfy the design requirements.

f) The tolerance of linearity and angular dimensions without tolerance unmarked shall conform to relevant stipulations of GB/T 1804.

g) The design and construction of water supply and drainage shall accord with relevant stipulations of CJJ122.

h) Electrical design, calculation and selection (such as switch, contactor, relay and guide line) shall be consistent with the requirements of GB 8408 and corresponding national electrical technical specifications and standards.

i) With regard to the electrical equipment installed in water pump house, recreation pool, water slide device, whitewater rafting, water attraction complex and nearby areas under the humid environment as well as decoration lighting equipment using unsafe voltage class, residual current operated protective device shall be set and conform to relevant stipulations of GB 8408.

4.1.3 For the main raw materials of water amusement ride, standard electromechanical products, electronic parts and components, auxiliary facilities and others, product quality certificates shall be available.

4.1.4 Effective anti-corrosion and anti-rust measures shall be taken for the components and parts of water amusement ride. Anti-corrosion, anti-rust and decorative coating shall be level, light and well-distributed, without flaking, foaming, obvious bruise, serious stripping, omission of coating and re-rust, wrinkling, sagging or pinhole or others.

4.1.5 When the water amusement ride is delivered, quality certificates, installation and use and maintenance instructions shall be available. For large-scale amusement ride, design documents, design authentication reports and supervision and inspection documents and others required by safety technical specifications shall be attached.

4.1.6 A nameplate of water amusement ride shall be set at the obvious position. The contents of nameplate of large-scale water amusement ride shall at least include name and address of manufacturer, product classification, Category of product, name of product, product model, grade, manufacturing license number, manufacturing date, factory number and main technical parameters of product (for the water slide device, running height, the maximum running speed, number of riders carried, and service life of the complete machine) and so on.

4.1.7 The base of water amusement ride shall conform to the following requirements:

a) Differential settlement, cracking and looseness shall not occur on the base;

b) The civil foundation of large-scale water amusement ride shall be constructed by the unit with corresponding qualification, and can be installed only after passing the acceptance of relevant departments.

4.1.8 The ornaments of water amusement ride shall be stable, safe and reliable structurally, and shall satisfy the following requirements:

- a) If the ornaments are installed on the large-scale water amusement ride, design drawings, load and calculation sheet and other design documents of the ornaments shall be submitted to equipment manufacturer for safety check before installation, and they can be constructed only after passing the check, and their safety shall be confirmed by the manufacturer after installation;
- b) If the ornaments (such as rockery, solution cavity and artistic modeling) are set around large-scale water amusement ride, the design drawings, calculation sheet and other materials for acceptance and inspection which satisfy relevant national stipulations shall be provided; and corresponding maintenance channel shall be set.

4.1.9 For all positions of water amusement ride accessible by riders, exposed sharp edges, sharp points, burrs and dangerous protrusions and others shall not exist.

4.1.10 The appearance of water amusement ride shall not be involved in any breakage or crazing or other circumstances which affect safety.

4.1.11 Welding shall be consistent with relevant stipulations of GB 8408, and the appearance quality of welded joint shall meet the following requirements:

- a) All weld beadings, slags and others shall be cleared up;
- b) Lack of weld, crack, burn-through, incomplete fusion, cluster porosity, collapse, serious undercut (the depth of undercut for steel boat shall be less than 0.5 mm), incompletely filled weld, slag inclusion and other appearance defects shall not occur on the surface.

4.1.12 The connection between bolt and axle pin shall accord with relevant stipulations of GB 8408

4.1.13 The components and parts shall satisfy the following requirements:

- a) The bending deformation and crack, damage and rusting affecting safety shall not occur.
- b) The surface of machining parts shall be bright and clean, without any crack, sharp point, burr or scratch, abrasion or rusting which affect safety.
- c) The crack, sharp point and deformation, burr, abrasion, rusting and others affecting safety shall not exist on the steel structure components.
- d) The burr and the crack, hole, serious defect, poor dipping, poor curing, bubble and others affecting safety shall not occur on the fiber-reinforced plastic parts.
- e) The sharp point, burr and the crack, breakage, deformation, abrasion and others affecting safety shall not occur on the non-metal parts such as rubber, nylon and polyurethane.
- f) The decay and the insect hole, cracking, knag and pith affecting safety shall not exist on the surface of wooden structure parts.

4.1.14 The effect of the noise generated from water amusement ride on regional environment shall conform to relevant regulation of GB 3096.

4.1.15 The water amusement ride and its auxiliary facilities shall not contaminate water quality and environment.

4.1.16 For the ground of the water amusement area available for riders to go through, slip-resistant measures shall be taken.

4.1.17 The safety instructional signage and safety warning sign for water amusement ride and amusement area shall be set in accordance with relevant stipulations.

4.1.18 The water amusement park shall be equipped with sufficient life guards, lifebuoys, saving

bars, safety ropes, stretchers and other emergency rescue tools and communication devices or equipment.

4.1.19 The shower-disinfection and disinfection pool shall be set at the entrance of amusement area. The length of disinfection pool shall be more than 2 m, its depth is 0.2 m and its breadth is the breadth of walkway.

4.2 Water slide device

4.2.1 Materials

4.2.1.1 Under the condition that the materials of water slide device are used and maintained in line with the requirements of installation and use and maintenance instructions, abnormal damage shall not occur on all parts of water slide device within design service life.

4.2.1.2 The water slide shall be made by fiber-reinforced plastic, stainless steel and other corrosion-resistant materials.

4.2.1.2.1 When the stainless steel material is adopted, its thickness shall be more than 3 mm.

4.2.1.2.2 When the fiber-reinforced plastic material is adopted:

- a) Alkali free glass fiber shall be used;
- b) The mechanical property of fiber-reinforced plastic part of water slide shall conform to relevant stipulation of GB 8408;
- c) The thickness of fiber-reinforced plastic part of water slide and flange shall be respectively more than 6 mm and 8 mm; the thickness of fiber-reinforced plastic part of children's water slide and flange shall be respectively more than 4 mm and 6 mm;
- d) If the thickness of fiber-reinforced plastic part of water slide is less than that stipulated in this article c), mechanical property test and strength calculation shall be performed one by one, and qualified test report of the third party and qualified calculation certification documents shall be provided;
- e) For the fiber-reinforced plastic part of water slide, those circumstances shall not occur, such as incomplete dipping, poor curing, layering of cutting face and uneven thickness, and crack, breakage, bulging, bubble, obvious repairing mark, wrinkle, unevenness, inconsistent hue and others shall not occur on the surface, and obvious lapping mark, burr, unevenness and wrinkle and others shall not exist on the other parts except for surface.

4.2.1.3 The structural support of water slide device shall use steel structure, and shall meet the following requirements:

- a) The structural strength is able to undertake the load designated in 4.2.2.2;
- b) The material of steel structure shall be corrosion-resistant, or the anti-corrosion measures suitable for local climate environment condition shall be adopted; it is suitable to adopt the hot-dip galvanizing method for corrosion prevention, and the hot-dip galvanizing shall meet relevant stipulations of GB/T 13912, and average thickness of galvanizing layer shall be more than 85 μm .

4.2.1.4 The connection of fiber-reinforced plastic part of water slide shall use stainless steel bolt, and effective anti-loose measures shall be taken.

4.2.2 Design

4.2.2.1 Design calculation

In respect of the water slide device, motion track, speed, acceleration, force condition,

lubrication water flow and structure and others shall be analyzed and calculated.

4.2.2.2 Design load

4.2.2.2.1 Static loading (Permanent load)

The static load of water slide device shall incorporate the load generated from water slide body, structural support, fastenings and auxiliary facilities (such as ornaments) and be expressed with G_k .

4.2.2.2.2 Live load (operation load)

The live load of water slide device shall incorporate the load generated from water, rider and slide raft and others under normal working condition. The water load, rider load and load of slide raft are stipulated as follows:

- a) The water load refers to the load generated from gravity of water flowing through inside water slide under the working state of water slide device, being expressed with W_L , and value fetching is stipulated as follows:
 - 1) Water load is generally 2 times more than the volume of water flowing through inside water slide;
 - 2) With regard to various water slide devices, it is suitable to consider the actual flow of lubrication water under normal working state. When the average inclination of water slide device is more than 5%, it can be calculated based on the value in Table 1; when the average inclination is less than 5%, the actual load of lubrication water shall be calculated

Note: The water slide categories are referred to in Annex A.

Table 1 Variable-value table of water load

Category	Water load/(kN/m)	Remarks
1	0	The water load is too small to be negligible
2	≥ 0.1	
3,4,5	≥ 0.2	
6.1,6.2	≥ 0.1	
7	$\geq 0.2 \text{ kN/ m}^2$	Wide summer toboggan run shall be calculated based on its area
8	According to the water volume under the actual working condition	

- b) Rider load refers to the load generated from gravity of riders, being expressed with Q_1 . It is generally stipulated as follows:

- 1) For adults' water slide, the load is calculated by 900 N per person, or calculated by 800 N per person when the number of riders is 2 or more;
- 2) For children's water slide (less than 1.2 m high or under 10 years old), the load shall be calculated by 450 N per person.

Note: "Slide load of rider" shall refer to B.1.

- c) Load of slide raft is expressed with H_L .

4.2.2.2.3 Environmental load

For environmental load, wind load, snow load, earthquake load and others shall be taken into consideration in general, and be respectively expressed with Q_7 , Q_8 and T . The load value shall be fetched and calculated based on relevant stipulations of GB 8408.

4.2.2.2.4 Impact effect

When the water slide device is running, the impact effect shall be considered. When the strength is calculated, live load shall multiply the impact coefficient, and the coefficient value is $K=1.5$.

4.2.2.2.5 Centrifugal force (inertia force)

The centrifugal force (inertia force) would come into being when riders are at the turning position in the course of slide. The inertia force is expressed with Q_9 . It is calculated and tested as follows:

- a) The centrifugal force depends on the gravity of riders, instant slide speed and turning radius. Refer to B.3 for the calculation example of centrifugal force.
- b) When the centrifugal acceleration is more than 2.6 g, the test for centrifugal acceleration is required. See B.2 for the maximum slide acceleration of riders.

4.2.2.2.6 Load combination

Load combination requiring considering all poor conditions, although those conditions may not take place at the same time. The load combination under the running and non-running states shall be analyzed and calculated based on the following requirements:

- a) b) Under running state, the calculation of strength and stiffness of components and parts shall consider the combination of the following loads, see formula (1);

$$P_1 = \Sigma G_K + K(Q_1 + W_L + H_L) + Q_7 + Q_9 \dots\dots\dots (1)$$

Where:

P_1 ——Load calculation after combination;

G_K ——Static loading;

Q_1 ——Rider load;

W_L ——Water load;

H_L ——Load of slide raft;

Q_7 ——Wind load under the wind speed of 15 m/s;

Q_9 ——Inertial forces;

K ——Impact coefficient is 1.5.

- b) Under non-running state, the effect of extreme environment factors such as wind, snow and earthquake on the structure of water slide device shall be taken into account, and structural strength and stability shall be calculated, and the structure shall be protected from plastic deformation. The load shall be calculated based on relevant stipulation of GB 8408.

4.2.3 Safety technical requirements

4.2.3.1 Surface of water slide

The surface of water slide shall meet the following requirements:

- a) The fillet radius of the edge of summer toboggan run shall be more than 3 mm;
- b) The motion track of water slide device shall be coherent, with smooth linetype, the slide surface shall be continuous and smooth, without sharp points, edges and corners, cracks, abnormal holes, clearances or deformation or others;
- c) The diameter and breadth of the hole and clearance for water supply and special effect and other purposes shall be less than 8 mm, and rounding is required, and rounding radius shall be more than 3 mm;
- d) The reverse gradient difference of butt joint of water slide device along slide direction is not required, the consequent gradient difference shall be less than 2 mm, and it shall be

ensured that no water leakage occurs at the joint position.

4.2.3.2 Entryway or stairway, starting platform and structural support

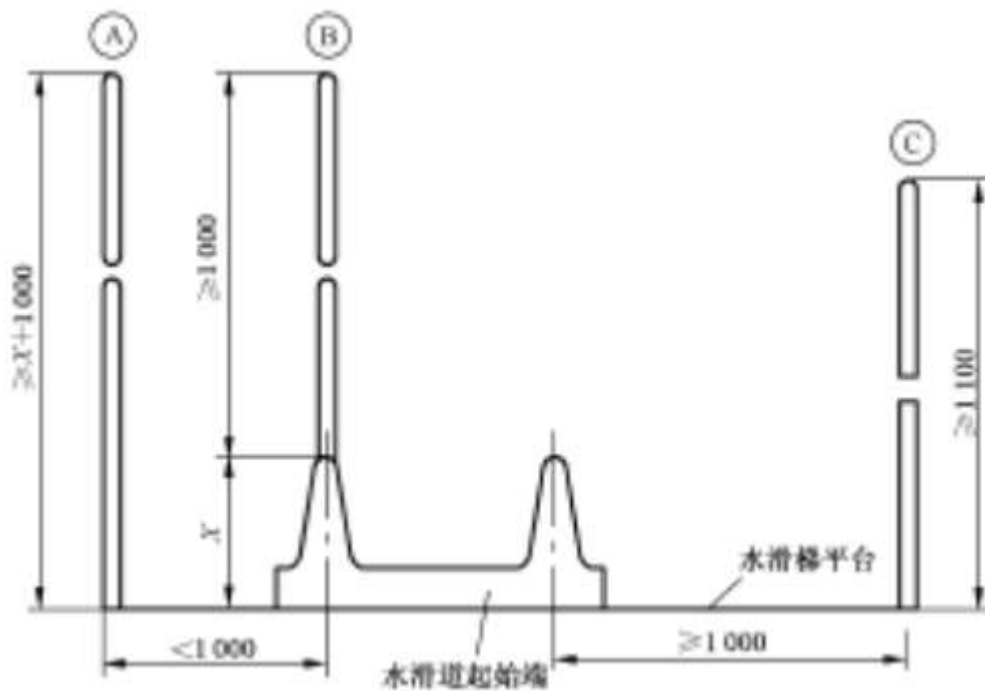
4.2.3.2.1 Entryway or stairway shall satisfy the following requirements:

- a) The clearance breadth of entryway or stair flight shall be more than 1.0 m, the clearance height shall be more than 2.0 m. The clearance breadth and height shall be respectively more than 1.2 m and 2.5 m when riders remove slide rafts by themselves; the clearance breadth and height shall be respectively more than 0.7 m and 2.0 m when children use them;
- b) The breadth of stair tread shall be more than 240 mm, and height shall be 140 mm-200 mm, and the fillet radius of the edge of stair tread shall be more than 3 mm; the slope of stairway shall keep consistent; the stairway shall be set in sections, and the number of stair steps shall be less than 18, the depth of middle (rest) platform shall be more than 0.8 m, and it shall be more than 1.2 m when riders remove slide rafts by themselves;
- c) Guard bars shall be installed on the two sides of stairway, with the height being more than 1.1 m. Vertical guard bars shall be used, and the clearance between guard bars and the clearance from ground shall be less than 120 mm;
- d) When the entryway is a slope, the slope shall be less than 1:6, when the anti-skid measures are taken, the slope shall be less than 1:4;
- e) The entryway or stair surface shall be anti-skid.

4.2.3.2.2 The starting platform shall meet the following requirements:

- a) It shall meet the needs of gathering and evacuation and management of riders; it is suitable to be built with steel material, concrete, wood or other materials which can bear the load of themselves and riders;
- b) When steel structure materials are used, the construction and quality acceptance and inspection shall accord with relevant stipulations of GB 50755 and GB 50205, while concretes and woods are used, the construction and quality acceptance and inspection shall accord with the requirements of relevant national standards;
- c) The platform surface shall be anti-skid and leakage-proof measures shall be taken;
- d) Safety fences with height being more than 1.1 m shall be set on the platform surface. When the height of platform is more than 12 m, the height of fences shall be more than 1.2 m, the fences shall be set vertically, and horizontal or slanting structures are not allowed. The clearance between fences and the clearance from ground shall follow relevant stipulations of 4.2.3.2.1 c); the setting method and height of safety fences for platform are available in Figure 1.

Dimensions in millimeters



Key:

- Ⓐ —— Safety fence within the distance smaller than 1 m from the peak of starting position;
- Ⓑ —— Handrail on the upper side of the peak of starting position of summer toboggan run;
- Ⓒ —— Safety fence at a distance larger than or equaling to 1 m from the peak of starting position;
- X —— Height of the peak at which riders may stand.

Figure 1 Height of Safety Fences for Platform

4.2.3.2.3 The structural support shall satisfy the following requirements:

- a) Its material and corrosion prevention property shall satisfy the requirements of 4.2.1.3 b);
- b) Critical welds include the bottom weld of supporting pillar, weld of flange of pillar, weld of pillar body and corbel connecting base as well as butt weld;
- c) Magnetic particle and penetration nondestructive tests shall be performed for critical welds in line with relevant requirements of GB/T 34370.3 and GB/T 34370.4, and quality grade is grade II;
- d) Critical welds shall not be welded at the installation site.

4.2.3.3 Starting position

The starting position shall meet the following requirements:

- a) A safety cross rod with 0.8 m-1.1 m high (from the surface of summer toboggan run to the bottom of handrail) shall be set at the starting position of body summer toboggan run so as to prevent riders from entering into the summer toboggan run in a standing pose.
- b) When the rider mechanical release device is used, relevant requirements of 4.2.3.7.4 shall be satisfied.

4.2.3.4 Slide zone

The slide zone shall meet the following requirements:

- a) In the process of slide, riders shall not be involved in being thrown, falling, rolling, bouncing, soaring, colliding, scratching, being burned, being detained and being squeezed and so on.
- b) In the process of slide, riders or slide rafts shall not go beyond the edge of summer toboggan run or guard board.
- c) When the special effect and function which may panic riders (such as water spray and lamplight) are used, riders shall be informed in advance.
- d) The daylighting for enclosed water slide or the invisible part of water slide device shall be strengthened, and riders shall be informed of necessary matters in advance, such as generation of psychology of fear and loss of sense of direction and other experience feelings.

4.2.3.5 Ending part

4.2.3.5.1 The structural form of ending part shall provide convenience for riders to finish the slide in a safe and comfortable manner, such as setting of catch unit and splashdown area.

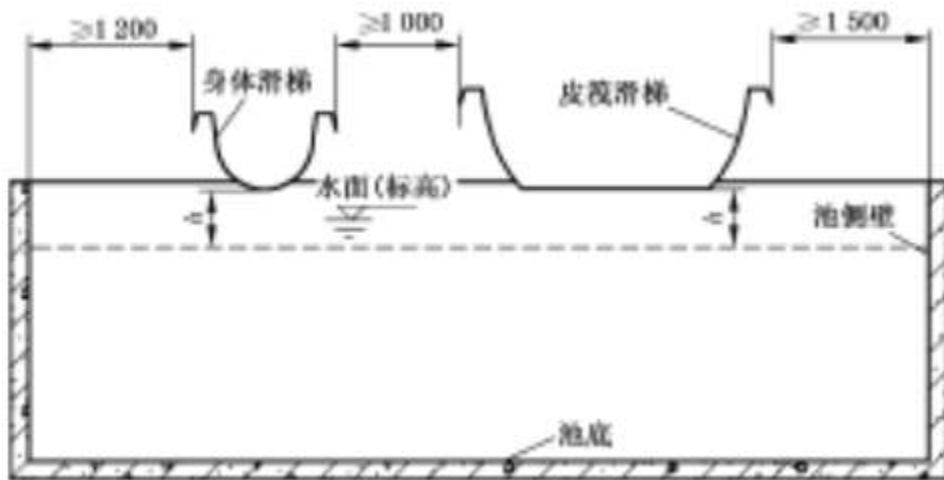
4.2.3.5.2 The catch unit shall satisfy the following requirements:

- a) The length of catch unit shall ensure that riders can fully stop sliding within the catch unit, and the water depth shall be less than 0.3 m;
- b) Riders shall be able to stand and walk safely and leave fast.

4.2.3.5.3 Various Categories of water slide devices can be designed to the form of splashdown area. The splashdown area shall satisfy the following conditions:

- a) The horizontal distance from the body water slide near the side of pool wall to side wall of the pool, and from the side edge of inner tube water slide (near pool wall) to the side wall of pool shall be separately more than 1.2 m and 1.5 m; the distance between side edges of adjacent water slides shall be more than 1.0 m. Relevant dimensions of end of water slide device and splashdown area are shown in Figure 2; it shall be ensured that the splashdown area has sufficient length to make riders stop sliding safely;

Dimensions in millimeters



Key:

$h < 200$ mm (children's water slide $h \leq 50$ mm).

Figure 2 Relevant Dimensions of End of Water Slide Device and Splashdown Area

- b) The water depth of the splashdown area special for inner tube water slide can be set in

sections, and the water depth within the range of 5 m of water entry area of riders shall be 0.8 m-0.9 m; the extension section from 5 m to the opposite bank of splashdown area shall be set slope form with a slope of 4%-6%, and its length shall conform to relevant stipulations of c) in this article; relevant dimensions of end of inner tube water slide and splashdown area are shown in Figure 3;

Dimensions in millimeters

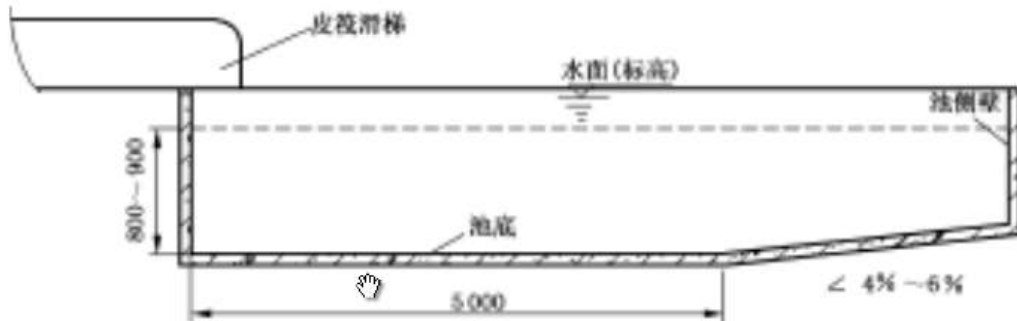


Figure 3 Relevant Dimensions of End of Inner Tube Water Slide and Splashdown Area

- c)The height from the falling point at the end of water slide device to the water surface of splashdown area shall be less than 200 mm, and the height from the falling point at the end of children’s water slide to water surface shall be less than 50 mm, and relevant dimensions of end of water slide device and splashdown area are shown in Figure 2;
- d)The height from the falling point at the end of upcast water slide device to water surface shall be less than 1.2 m, the distance from the pool wall near the side of splashdown position shall be more than 500 mm, and the upcast angle shall be less than 30o, and relevant dimensions of end of upcast water slide device and splashdown area are shown in Figure 4;

Dimensions in millimeters

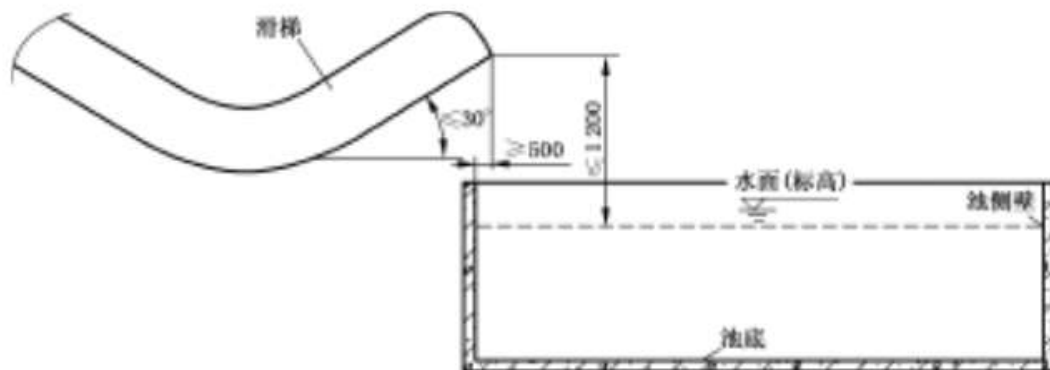


Figure 4 Relevant Dimensions of End of Upcast Water Slide Device and Splashdown Area

According to the requirements of GB/T 2

- f)The riders in adjacent slides shall be prevented from mutual collision in the splashdown area.

4.2.3.6 Exit Passageway

The exit passageway shall meet the following requirements:

- a)For the exit passageway from splashdown area to ground, it is suitable to adopt the form of

escalator, ladder or slope;

- b) The exit passageway shall not cross with the passageways of other water slides;
- c) If the end of several summer toboggan runs is on the one side of falling pool, the exit passageway shall be set on the other side so that riders can walk and passageways can be separate from those of other riders.

4.2.3.7 Accessories and auxiliary facilities

4.2.3.7.1 The guard board shall satisfy the following requirements:

- a) At the change position of slide direction and turning position of open water slide, guard boards shall be set outside summer toboggan run (inside), and their height shall be able to prevent riders from sliding out from the side;
- b) The surface of guard boards shall be smooth, and the guard boards can not only be principal part of summer toboggan run, but also independent components, and the connection between guard boards of independent components and components of summer toboggan run shall be solid, and the transition shall be smooth;
- c) The transition position from no guard board to setting of guard board shall be equipped with a guard board at the maximum inclination angle of 60° with slide direction, and the schematic diagram of transition guard board is shown in Figure 5.

Dimensions in millimeters

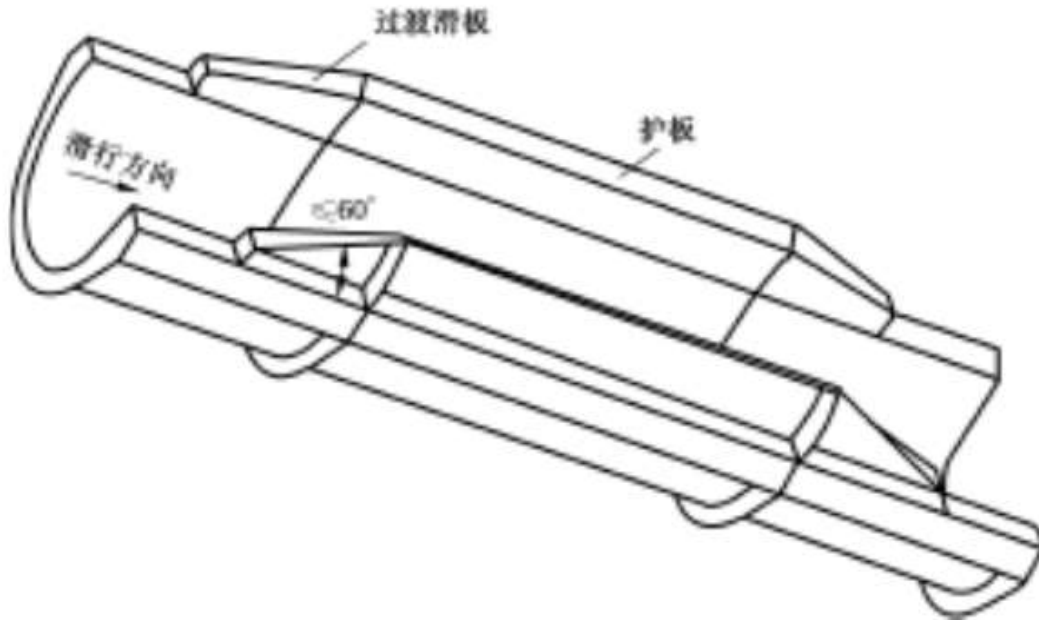


Figure 5 Schematic Diagram of Transition Guard Board

4.2.3.7.2 Other accessories shall meet the following requirements:

- a) For the cover board and entrance to summer toboggan run of enclosed water slide installed outside starting position of water slide, the smooth transition at the maximum angle of 60° shall be available on the two sides of water slide, and smooth transition flanging shall be equipped, and its radius shall be more than 100 mm. The clearance height of cover board shall be more than 1.2 m. See Figure 6 for transition.

Dimensions in millimeters

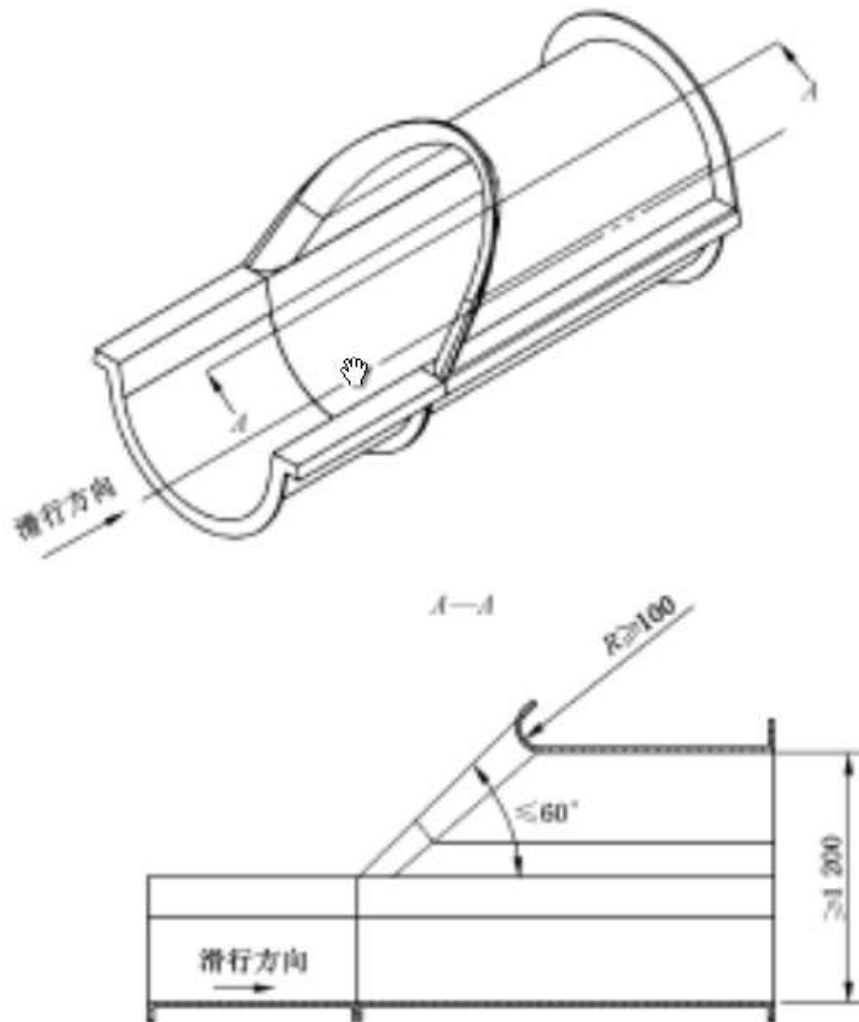
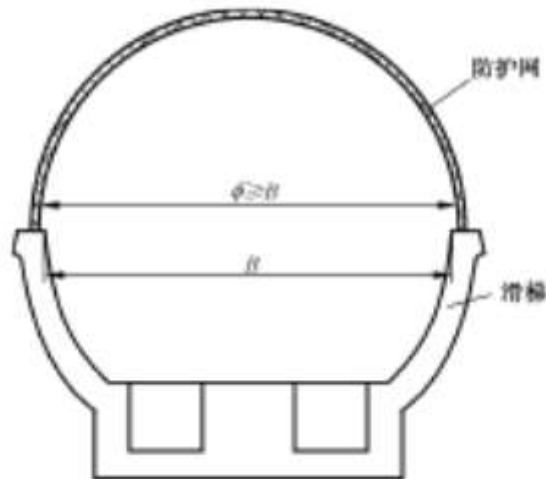


Figure 6 Transition

b) In order to decorate or eliminate the psychology of fear of riders, protective screening can be installed on the water slide. The schematic diagram of protective screening is shown in Figure 7.

- 1) The protective screening shall be arc, and its diameter of section shall be more than the maximum breadth of section of water slide;
- 2) Net rope shall use corrosion-resistant material, with proper rope diameter, and mesh shall be less than 50 mm?50 mm;
- 3)The structure support of net rope shall be made of stainless steel material or anti-corrosion measures shall be taken, with compact and solid support and certain pretension force;
- 4)The connection with summer toboggan run shall be firm



Key:

ϕ ——Diameter of protective screening;

B——The maximum breadth of section of water slide.

Figure 7 Schematic Diagram of Protective Screening

4.2.3.7.3 The slide raft shall satisfy the following requirements:

- a) It shall be selected based on technical parameters, using functions and running conditions and others of water slide;
- b) It shall be able to be swiftly separated from riders, and convenient and comfortable riding shall be ensured;
- c) It shall be able to float on water surface;
- d) It shall accord with relevant stipulations of 4.1.9, and handrail shall be firm and reliable;
- e) Main technical parameters (such as dimension, number of riders carried, weight and inflation pressure), range of application and use and maintenance methods as well as others shall be marked.

4.2.3.7.4 Rider mechanical release device shall satisfy the following requirements:

- a) The release speed of rider shall be less than 0.5 m/s;
- b) Its structure and strength shall satisfy using safety, and it shall firmly connect with starting platform, and connect naturally and transit smoothly and joint reliably with the entrance to slide zone;
- c) The manual release control method shall be adopted, and the electrical control circuit shall use safety voltage and be interlocked with warning device;
- d) The carrying roller shall use stainless steel material;
- e) When the number of riders carried is 4 and more, it is suitable to adopt rider mechanical release device.

4.2.3.7.5 The raft conveyor shall meet the following requirements:

- a) The ramp-up speed shall not exceed 0.5 m/s;
- b) Its structure and strength shall satisfy using safety;
- c) The measures shall be taken to separate from starting platform and splashdown area;
- d) The control box of starting platform and splashdown area shall use safety voltage, and emergency stop switch shall be set; earth leakage protection shall be set for heavy current system;

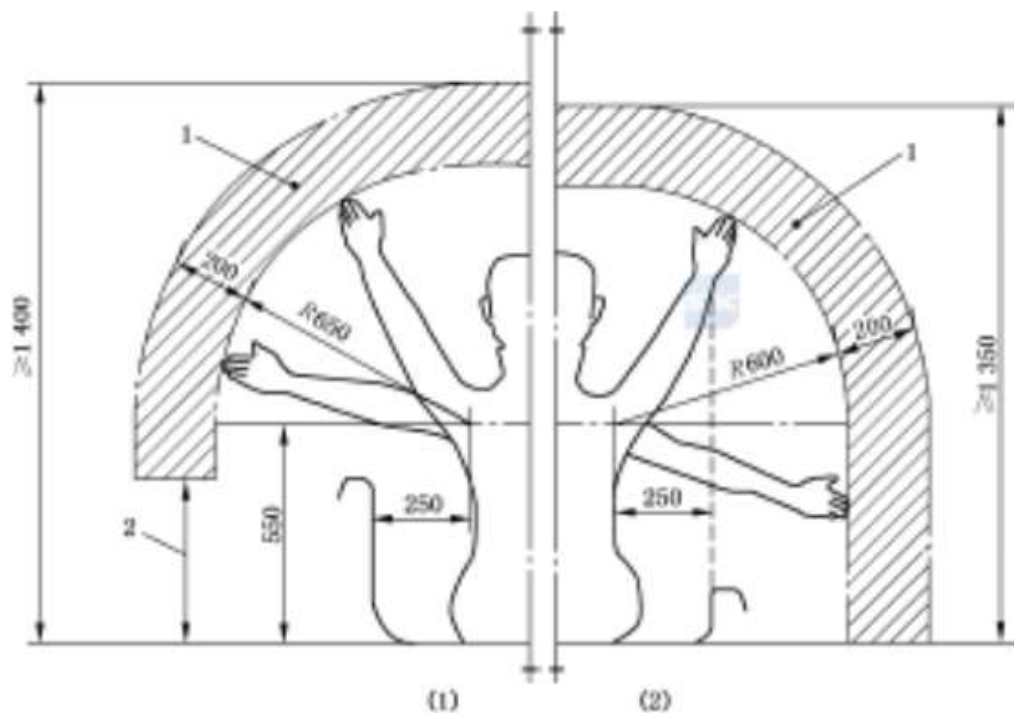
e)The slide raft carrying 6 riders and more shall be fitted with raft conveyor.

4.2.3.8 Clearance zone

The clearance zone shall satisfy the following requirements:

- a) Appropriate clearance zone shall be established around water slide. See Figure 8 for the clearance zone and dimension of water slide;
- b) For the inner tube water slide or mat sliding water slide, the dimension of clearance zone shall be enlarged accordingly on the basis of dimension in Figure 8;
- c) Fixed objects and structures shall not be put within the clearance zone, and inevitable objects shall be put within the scope of extended clearance zone, and protective devices with smooth surface, regular shape and edge fillet radius being more than 100 mm shall be installed accordingly.

Dimensions in millimeters



Key:

- 1-Extended clearance zone;
- 2-Height of section of water slide;
- (1) Suitable for Category 3, 4, 5 and 6 (curve slide);
- (2) Suitable for Category 1, 2, 6 (straight slide) and 7.

Figure 8 Clearance Zone and Dimensions of Water Slide

4.2.3.9 Water supply

Water supply shall meet the following requirements:

- a) Flow control of lubrication water has great influence on sliding function and safety performance and shall be performed from design, manufacturing, installation, commissioning, using and management as well as other aspects;
- b) Lubrication water shall be appropriate to ensure safe and smooth sliding and running of

riders and slide rafts;

- c) The reasonable regulation range of lubrication water flow shall be set and marked at the time of commissioning, and the personnel without authorization shall not adjust or change it at random;
- d) The change of lubrication water flow affects the water slide device which is sensitive to safety performance, so online flow monitoring device with automatic alarm function shall be set for flow monitoring and measurement.

4.2.3.10 Control of mutual interference among riders

In order to avoid mutual interference of riders, the following requirements shall be satisfied:

- a) The interval between front and back riders (slide rafts) shall be set so as to avoid collision;
- b) The signal warning device shall be set; when it is hard for attendants of summer toboggan run on the starting platform to see the whole process that riders slide to ending part, the signal warning device shall be set, if the water slide is equipped with rider mechanical release device, it shall be interlocked with warning device;
- c) Appropriate contract and communication tools shall be provided for the attendants of summer toboggan run on the starting platform and ending part, and misoperation shall be avoided.

4.2.3.11 Additional safety technical requirements

Additional safety technical requirements are as follows:

- a) See Appendix A for additional safety technical requirements;
- b) Category 8 shall conform to the following requirements:
 - 1) When a Category of water slide device with different section shapes transits to another Category, it shall be smooth and natural. For example, the lambdoidal connection of big trumpet and boomerang water slide device, the angle of entry point at the acceleration section of behemoth bowl and upstream and downstream connection at the bottom of bowl as well as the shapes and dimensions of relevant structures in other positions shall be controlled appropriately so as to prevent riders from being collided, rolling and being hurt;
 - 2) The plug flow (including reverse plug flow) and backwater grating surface installed within the slide area shall be flush with surface of summer toboggan run, and fixed and firm, and the clearance generated therefrom shall meet relevant requirements of 4.2.3.1 c);
 - 3) The boost installation of water roller coaster (water dragon) shall be jointed reliably with corresponding summer toboggan run and water duct, and the junction between boosting mouth and surface of summer toboggan run shall be smooth and adjustable;
 - 4) Online monitoring and signal warning devices for lubrication water flow shall be installed, and see 4.2.3.9 d) and 4.2.3.10 b) for details.

4.3 Amusement pool

4.3.1 Amusement pool classification

The classification of the amusement pool is as follows:

- a) It may be divided into waving pools, splashdown area (slide falling pool), rafting River, massage pool, leisure pool, competitive pool, wading pool (or paddling pool), etc. in accordance with the use function.
- b) It is divided into adult pool, children (swimming) pool, baby (swimming) pool and so on

based on age of riders.

4.3.2 Water depth of recreation pools

The water depth of recreation pools is stipulated as follows:

a)The water depth of recreation zone of waving pools shall be less than 1.8 m, and the bottom of the pools shall be slope form with a slop being less than 8%;

b)The water depth of splashdown area of water slide is generally 0.8 m-0.9 m; the water depth of splashdown area of children's water slide shall be 0.3 m-0.6 m;

c)The water depth of splashdown area of special water slide is generally 0.9 m-4 m;

d)The water depth of drift river shall be less than 1.2 m;

e)The water depth of baby pool shall be less than 0.3 m; the water depth of children pool shall be less than 0.6 m;

f)The water depth of water pool for bumper boats shall be less than 1.5 m.

4.3.3 Rafting River

4.3.3.1 The average velocity on the surface of drift river (such as lazy river, white water river, tidal river and huge flood canyon) shall be less than 2 m/s.

4.3.3.2 Its breadth shall not be less than 2.5 m.

4.3.3.3 The plug flow, waving device and auxiliary facilities shall not hurt riders.

4.3.3.4 The setting of water outlet of water circulation system shall conform to the stipulations of 4.3.5.1.

4.3.4 Waving pool

4.3.4.1 The wave height of game wave shall be less than 1.2 m while the wave height of wave in a greater degree shall be less than 3.0 m.

4.3.4.2 A prominent manual reset emergency stop button shall be installed in the obvious monitoring sentinel at high position around the waving pool for stop operation in case of emergency. If the wireless remote sensing control switch is used, relevant stipulations of GB 8408 shall be satisfied.

4.3.4.3 A safety fence shall be installed on the wave outlet of waving pool, a safety separation net or floating warning line and other devices shall be set at the distance of 3 m at least away from the deep water area along the length direction, and the safety warning sign shall be available and meet relevant requirements of GB 2894.

4.3.4.4 The vacuum energy storage waving equipment shall be adopted, and the area of ventilation opening of machine room shall be 6 times bigger than the vent of vacuum valve; the isolation devices shall be installed nearby the vacuum valve so as to prevent riders and objects from being inhaled into vacuum chamber.

4.3.5 Others

4.3.5.1 Two sets of independent and fixed safety gratings which cannot be moved by non-professional persons at least shall be installed on the water outlet of water circulation system, and the clearance between gratings shall be less than 8 mm, and the flow rate passing through grating shall be less than 0.2 m/s, and it shall be avoided that the gratings are set within the area where riders move. If they are installed on the pool wall accessible for riders due to failure of being avoided, the safety gratings shall be set to be spherical crown shape, and the safety warning signs such as "dangerous, do not get close" shall be provided at the position above upper waterline of safety gratings.

4.3.5.2 It shall be ensured that no water leakage occurs in the recreation pool, pool wall is smooth,

no edges and corners occur on the pool edge and stair, the bottom of pool shall be anti-skid; embedded parts shall not be exposed, and protection measures shall be taken when unavoidable.

4.3.5.3 The pool edge shall be set to be the construction form which can prevent surrounding rainwater and wastewater and others from flowing into the pool.

4.3.5.4 Various recreation pools shall be arranged respectively, if water areas are connected, isolation devices are required.

4.3.5.5 For the water area with change of water depth, the striking signs of water depth shall be provided at the corresponding positions of pool wall around the recreation pool.

4.3.5.6 A monitoring sentinel at high position shall be established in the area with wide water surface or unobservable area in the recreation pool, and on the two sides of the area with water depth above 1.5 m in the waving pool as well as on the river bank of concealed turning of drift river or at an appropriate position.

4.3.5.7 Per capita water area of recreation pool shall be more than 2 m² at the same time. Sufficient dressing rooms, shower rooms, toilets and safe-keeping boxes and others shall be arranged according to rated rider capacity of recreation pool.

4.3.5.8 Adequate lighting shall be available for indoor and outdoor recreation pools. Indoor daylight factor shall be 1/5-1/4. Outdoor lighting lamps shall be waterproof. With regard to the recreation park with evening shows opened, its illumination of water surface shall be more than 80 lx. Air regenerating device shall be installed indoor and air exchange 3 times at least per hour shall be ensured.

4.3.5.9 The water quality and air of recreation pools shall satisfy relevant stipulation of GB 9667 and CJ 244.

4.4 Interactive aquatic play structure

4.4.1 The game pool shall have proper space to satisfy the basic requirements for safety running of game equipment, for instance, the ending part of water slide and clearance zone shall satisfy relevant requirements of 4.2.3.5 and 4.2.3.8; the water sprinkling device shall meet the requirements for the minimum safe distance and so on.

4.4.2 The safety technical requirements of each unit of the interactive aquatic play structure should comply with the relevant provisions of GB 8408. Net (bridge) between units shall be firm and reliable, the range of swing of hanging bridge shall not be too big, and the guard bars on the two sides shall be safe and reliable.

4.4.3 The platform, stair and railing of the interactive aquatic play structure should meet the requirements of 4.2.3.2.

4.4.4 The water slide device of the interactive aquatic play structure should meet the requirements of 4.2.

4.4.5 Among water attraction complex, the weld of welding shaft of water skip bucket which can bear more than 750 N shall meet relevant requirements of 4.2.3.2.3 c) d).

4.4.6 For the jet-type game devices, high-pressure jet devices which may hurt riders shall not be used.

4.4.7 The range of swing of rocking game facilities shall not make riders shake and swing severely, and riders shall be prevented from being squeezed.

4.4.8 The structures and parts involved in personal safety in water attraction complex shall be consistent with relevant stipulations of GB 8408.

4.5 Whitewater rafting

4.5.1 In respect of whitewater rafting, video monitoring device shall be installed for whitewater rafting observation by operating personnel.

4.5.2 The area with deep water storage such as pump station shall be effectively isolated from running watercourse. The protective fence with interval being less than 100 mm shall be installed on inlet and outlet of water pump.

4.5.3 When a belt is used for hoisting, the belt tension shall be regulated in a proper way, without any slip; when double belts or double hoisting chain structures are used, two belt or two chains shall be synchronized. The slope of hoisting device shall be reasonable. Anti-rolling-back and evacuation measures shall be taken.

4.5.4 The water volume of drifting facilities shall be controlled within the range of design requirements. The water depth when a drifting boat runs shall meet the safety requirements, and the raft body shall not touch or scrape the bottom of water tank or underwater devices or have other circumstances. A calibrated scale for water level shall be set at the obvious position of inner wall of watercourse nearby platform.

4.5.5 The design slope of drifting watercourse shall be reasonable, and turning radius shall be appropriate; the inner wall of drifting watercourse shall be smooth and level, without any sharp point or sudden change or other defects affecting running of drifting boats or safety of riders; the bulge and barrier which affect personal safety of riders shall not exist on the top of watercourse and two sides; the fixation of wave-making devices at the bottom of watercourse shall be reliable; for the design of watercourse, the effect of temperature change on watercourse structure shall be taken into consideration. The design of water circulation system shall be reasonable.

4.5.6 The raft body of drifting boat shall be solid and durable, and the compact foam materials shall be used to fill the chamber. The safety belt and handrail shall be provided on the raft body. When the raft tire uses the pneumatic tire, obvious air leakage shall not occur; it shall be ensured that the pneumatic tire does not cause the overturn of drifting boat under the normal working condition and abnormal local breakage. When the inner chamber of the pneumatic tire is air chamber, the number of air chambers shall be more than 6, or the compact foam materials shall be used for the core structure of the pneumatic tire.

4.5.7 Anti-skid measures shall be taken for the pedal plane of drifting boat and its entrance and exit.

4.5.8 The running speed of drifting boat shall be moderate. It shall be ensured that no excessive shock or collision with watercourse which affects riding safety of riders occurs when the raft body is running; the running speed of raft body shall match with hoisting device and boat stopping device when it enters into hoisting areas and stations and other places; the raft body shall not be involved in the possibility of overturn and mutual collision in the course of drifting.

4.5.9 The electrical control system of white water rafting shall conform to relevant stipulations of GB 8408. With regard to the dispatching interval, automatic control function shall be set, when other parts of electrical system requires disconnection of protection system, the stop of water pump shall be prolonged.

4.6 Leisure boats

4.6.1 Leisure boats include powered solar energy boat, power boat, outboard motor boat, bumper

boat, unpowered lute boat and water bicycle.

4.6.2 The moving parts and mechanical equipment on board shall be able to work normally under the condition of 10° transverse inclination and 5° longitudinal inclination.

4.6.3 The shell plate and keel and other materials of steel boat shall use common carbon steel, its seat board shall be manufactured with wood or fiber-reinforced plastic, and the wood shall meet the requirements of secondary material of GB/T 153.

4.6.4 The boat with fiber-reinforced plastic and the property and requirements of fiber-reinforced plastic shall meet relevant stipulations of GB 8408.

4.6.5 The keel and other stress components of wooden boat shall use oak or fraxinus mandshurica, while shell plate and seat board and others shall be made of cedar or pine.

4.6.6 The leisure boat shall have sufficient strength, under the condition of 25% overload, the deformation degree of steel and wooden facilities or boats along length direction L and beam direction B shall not exceed 0.25%; the deformation degree of the facilities with fabric-reinforced plastic or boats along length direction L and breadth direction B shall not be exceed 0.35%, and the permanent deformation shall not exist after unloading.

4.6.7 When the outer shell body is coated with fabric-reinforced plastic, the extension part of the outer shell body shall be coated at the same time or the test sample shall be made separately under the same construction conditions as the shell, its dimension is 300 mm×300 mm, and its physical and mechanical properties shall meet the requirements of Table 2.

Table 2 Physical and Mechanical Properties of Shell Sample

Items	Glass fabric	Glass mat
Glass fiber content/%	≥45	≥28
Tensile strength/MPa(kgf/cm ²)	≥150(≥1.5X10 ³)	≥86(≥8.6X10 ²)
Bending strength/MPa(kgf/cm ²)	≥170(≥1.7X10 ³)	≥140(≥1.4X10 ³)

4.6.8 Various leisure boats shall have sufficient stability in construction, with transverse inclination being less than 3° and longitudinal inclination being less than 5° under the state of static floating.

4.6.9 If the hull has an opening, the water tightness at the opening position shall be ensured, and water is not allowed to flow back from the opening position to inside hull, and leakage shall not exist in the hull. During the installation of the through-hull accessories, water tightness and air tightness shall be ensured so that any liquid does not penetrate into the hull.

4.6.10 Various leisure boats shall be equipped with protective devices which can bear collision. The suspension ring device of boats shall be safe and reliable.

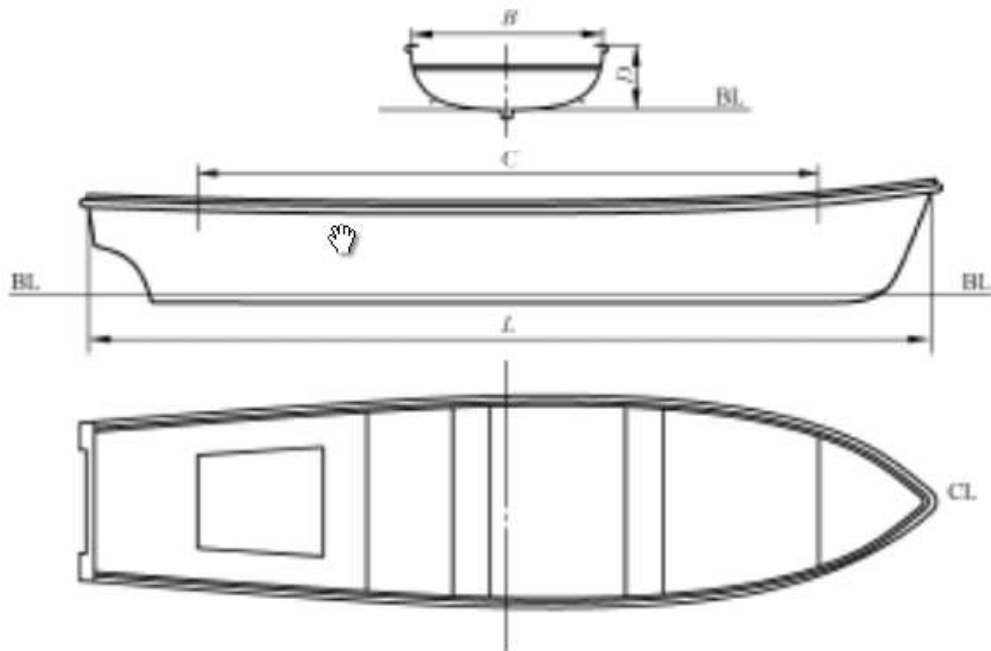
4.6.11 The joystick and pedal crank of various unpowered boats shall rotate easily and flexibly, clamping and stagnation are not allowed. Its turning force and steering tension shall be less than 30 N.

4.6.12 The steering tension of various powered boat shall be less than 30 N, and under the condition of load draught at the maximum route speed, it takes 20 s at most from one shipboard with full rudder to the other shipboard with full rudder.

4.6.13 Various leisure boats shall be equipped with handrails, with solid seats. Anti-rust measures shall be taken for the handrails.

4.6.14 When the route speed v of leisure boats is more than 3.7 m/s, corresponding lifesaving equipment shall be equipped.

4.6.15 The regulation on allowable deviation of basic dimensions of leisure boats is shown in Figure 9.



Key:

Length $L \pm 0.5\%$; beam $\pm 1.0\%$; molded depth $D \pm 1.0\%$.

Figure 9 Allowable Deviation of Basic Dimensions of Leisure Boat

4.6.16 Power boat (including battery boat and outboard motor boat) shall be manufactured and run in line with the following safety requirements:

- a) The selected engine shall be able to start easily and run reliably, and be firmly installed at the position with sufficient rigidity;
- b) The distance from propeller axis to light waterline surface of boat shall be more than $0.7 d$ (d refers to the diameter of propeller);
- c) When the shafting goes through the shell plate and watertight bulkhead plate, water tightness shall be ensured;
- d) The maximum route speed of speedboat shall be less than 25 km/h;
- e) For the power boat requiring fuel, its fuel tank shall be ventilated, and it shall be ensured that the no leakage occurs in the entire oil-way;
- f) The maximum route speed of bumper boat shall be less than 10 km/h;
- g) The inflation pressure of bumper boat shall be less than 0.3 Mpa;
- h) The front operating machine shall ensure that the steering machine, soft axis, pull rod, outboard motor or rudder for course control are jointed reliably and work freely.

4.6.17 For the transmission device of power section of power boat, a covering shall be used to strictly separate from riders.

4.6.18 The main circuit of battery boat shall be fitted with short-circuit protection device, and the working voltage on board shall be less than 50 V.

4.6.19 The marine storage battery shall be sealed properly. Under the rated load, the continuous working hours for the storage battery shall be more than 4 h, the storage battery shall be set out under the ventilated environment, and the technical property of the marine storage battery shall

conform to the stipulations of GB/T 7403.1.

5 Test method

5.1 Test conditions

5.1.1 The wind speed shall be not greater than 10 m/s.

5.1.2 The allowable error of test load shall be $\pm 5\%$ of rated load.

5.2 Test apparatus and inspection instruments

The test and inspection apparatus and tools with corresponding precision shall be selected based on actual needs of test items.

5.3 Test for water slide device

5.3.1 Static test

The test items, basis and methods for static test shall follow the requirements of No. 1, 2, 6, 8-12, 16, 19-21 in Table 3 mentioned in “6.1.2.2 a) Test for water slide device” and “6.1.2.1 General test for water amusement ride”.

5.3.2 Operation test

5.3.2.1 Contents and requirements

5.3.2.1 Contents and requirements are as follows:

a) The contents of the test should include the requirements of 4.2.2.2.5b), 4.2.3.1b), 4.2.3.2.1e), 4.2.3.2.2c), 4.2.3.4a)b)d), 4.2.3.5.2, 4.2.3.5.3a)b)f), 4.2.3.7. 1a), 4.2.3.7.3b)c), 4.2.3.7.4a) b) c), 4.2.3.7.5a)d),4.2.3.9b)c), 4.2.3.10a)b), 4.2.3.11b) 1)3)4) and the maximum speed and average speed of the slide.

b)Running test shall be performed after test items pass the static test.

5.3.2.2 Procedure and method

Procedure and method are as follows:

a)Test preparations shall be made based on test outline;

b)The test of human body simulant shall be performed at first and be respectively carried out according to the different weight combinations allowed by design, and each combination shall be tested 5 times at least, and then test results shall be observed and recorded; after the test is passed, the human body test is then performed, in case of disqualification, corresponding corrections shall be made until the problem is solved;

c)The human body test is respectively performed by trial run personnel according to different weight combinations allowed by design (error is $\pm 5\%$ of total rated load), and the test shall be performed 50 times at least for each combination.

5.3.2.3 Test Report

The test report is as follows:

a)A test report is prepared by the person in charge of test or commissioning, and checked by Quality Assurance Engineer or the personnel with corresponding qualification, and original records shall be attached;

b) The test report shall include at least, but not limited to the following:

1) Test location, time;

2) Item name and serial number;

3) Equipment diagram and performance information;

- 4) Basis of test;
- 5) Test method, step description, record and test results;
- 6) Number of report and date of issue.

5.4 Testing of whitewater rafting

5.4.1 The design verification test shall be performed for the new trail-produce products to verify whether the safety and reliability of the products can satisfy the requirements. Before the test, test plans shall be made, and test plans for critical components and parts shall be made when necessary. The test plans shall at least include test contents, test methods, test times or time and qualification criterion.

5.4.2 Newly-installed products shall be checked in detail. After everything goes well upon confirmation, no load, full load and bias load tests shall be performed. The time for continuous full load test shall be more than 8 h every day, and accumulated time shall be more than 80 h. The bias load working conditions shall include the most unfavorable condition under which the products are allowed to be used.

5.4.3 The bias load test for products requires the maximum bias load and is performed according to 700 N per person.

5.4.4 After all tests are finished, a test report with clear conclusion and in compliance with relevant stipulations shall be prepared. The contents of the report shall conform to relevant requirements of 5.3.2.3.

5.5 Test for leisure boat

5.5.1 Safety test for leisure boat

The safety test methods for leisure boat shall meet the following requirements:

- a) The test shall be performed in still water or the water area with less effect from running water;
- b) The rated load shall be increased according to actual working conditions, and freeboard shall be more than 150 mm. The distance from the edge of bumper boat to water surface shall be more than 300 mm.

5.5.2 Hull static strength loading test

The methods for hull static strength loading test shall meet the following requirements (excluding bumper boat):

- a) The light boat shall be put into water to measure length and beam.
- b) Test load shall be arranged in the boat in a well-distributed way, and the load shall be calculated by Formula (2):

$$W = 0.25G_1 + 1.25(G_2 + G_3) \dots\dots\dots (2)$$

Where:

W —— The test load, in kg;

G₁ —— The light weight, in kg.

G₂-Weight of equipment (weight of power boat including machinery equipment), and unit is kilogram (kg);

G₃-Weight of full rated riders, unit is kilogram (kg).

c) After the loading for 5 min, the length and beam shall be measured, its deformation degree and others shall conform to the stipulations of 4.6.6.

d) When all loads are removed, the permanent deformation shall not occur on the leisure boat,

but the measurement error being less than 1 mm is allowed.

5.5.3 Hull water proof test

The methods for hull water proof test shall abide by the following requirements:

- a) The watertight test shall be performed after the strength test, and the inside of the boat shall be clean, without painting before the test;
- b) When the ballast equivalent to the weight of all approved riders and equipment is loaded fully on board and floats on the water surface in a static way for 2 h, the leakage phenomenon shall not occur on the boat with steel material and fabric-reinforced plastic, and the water immersed into the wooden boat shall not reach the lower edge of keelson;
- c) The test for marine laminated board with fabric-reinforced plastic (including hull and seat) shall follow the requirements of GB/T1447, GB/T 1449, GB/T 1451, GB/T 1462 and GB/T 2577;
- d) The boat that fails to pass the watertight test is allowed to be retested after defects are eliminated until being qualified.

5.5.4 Stability test

The methods for stability test shall meet the following requirements:

- a) The test shall be performed in still water or the water area with less effect from running water. The effect of wave and running water shall be avoided as far as possible at the time of test, and the boat shall be upright, without any transverse inclination;
- b) When the test is required to be performed under the condition of full load, the ballast can be used to replace load, and the distance from the center of gravity of ballast to upper surface of seat board shall be 300 mm;
- c) Left and right freeboard values of the boat shall be respectively measured, and their average value is the value of freeboard of the boat;
- d) For the shift weight adopted for heeling moment test, 4% of full load shall be selected and be divided into two groups, and be respectively put in both sides of boat center so that the boat respectively tilt towards the right and left once;
- e) A plumb bob shall be provided in the boat center, and the effective length of the plumb bob is 2 m. A horizontal scale shall be set under the plumb bob to read the inclined distance of the plumb bob when the boat inclines towards the left and right so as to determine the value of dip angle. The accurate tiltmeter can also be used for direct measurement;
- f) Initial stability GM shall be calculated according to the measured value of dip angle by Formula (3) or Formula (4) and its value shall be more than the value obtained via Formula (5)

$$GM = \frac{W_1 S}{2D} \left(\frac{1}{\tan\theta_{\text{左}}} + \frac{1}{\tan\theta_{\text{右}}} \right) \dots\dots\dots (3)$$

Where:

GM ——Nital stablity height, in m;

G ——Shift weight, in kg.

S ——Shift distance, in m;

D ——Displacement, in kg;

θ_{left} ——Heeling angle towards the left;

θ_{right} ——Heeling angle towards the right;

$$GM = \frac{W_1 S}{D} \left(\frac{1}{L_{\text{左}}} + \frac{1}{L_{\text{右}}} \right) \dots\dots\dots (4)$$

Where:

- GM ——Nital stability height, in m;
- G——Shift weight, in kg.
- S——Shift distance, in m;
- D——Displacement, in kg;
- L_{left}-Swing distance of plumb bob towards the left, unit is meter (m);
- L_{right}-Swing distance of plumb bob towards the right, unit is meter (m);

$$GM = 0.05B^2 - 0.05B + 0.20 \dots\dots\dots (5)$$

Where:

- GM ——Nital stability height, in m;
- B-molded breadth of boat, unit is meter (m).

The stability of power boat (except for bumper boat) shall meet not only the above mentioned requirements but also the requirements in Formula (6):

$$\frac{G(B - 0.2)}{4DGM} \leq K \frac{F}{B} \dots\dots\dots (6)$$

Where:

- G-Weight of all approved members, unit is kilogram (kg);
- D—— Displacement, in kg;
- GM —— Nital stability height from test, in m;
- F ——Freeboard value, unit is meter (m);
- B-Molded breadth of boat, unit is meter (m);
- K —— Coefficient, K=1.

5.5.5 Reliability test and velocity measurement for the power device of power boat

The reliability test and velocity measurement for the power device of power boat shall meet the following methods and requirements:

- a)The test shall be performed in the spacious water area and at full load;
- b)When the engine continuously operate at full load for 4 h, its operation shall be normal, reliable and fixed and firm in the whole process, the operation condition of shafting shall be checked at the same time, and the working condition of cooling and lubrication system shall be observed;
- c)The engine shall be tested no less than 5 times from full load to stop;
- d)The velocity measurement shall be performed in the surgeless water area as far as possible. The depth of water area shall be more than 2 m, and it is suggested that the distance between marker posts for velocity measurement is more than 100 m.

5.5.6 Working time measurement of battery boat

The battery with the sufficient electricity shall work continuously under the rated load. When its voltage is reduced to 85% of rated value, its working time shall conform to the stipulations of 4.6.19.

5.5.7 Test Report

The test report shall include at least the following:

- a) The related test (name, personnel, location and test conditions);

- b) The clauses of standards for test basis;
- c) The specific test methods;
- d) The result, including the relevant calculation content;
The difference from test procedure;
- f) Test date.

6 Inspection Rules

6.1 Inspection

6.1.1 Sampling method for water amusement ride test

The sampling method for water amusement ride test is one hundred percent sampling.

6.1.2 Items, basis and methods for water amusement ride test 6.1.2.1 General test for water amusement ride

Items, basis and methods for general test of all Categories of water amusement ride are shown in Table 3

Table 3 Items, Basis and Methods for General Test of All Categories of Water Amusement Ride

S.N	Inspection items	Inspection basis (clauses in this standard,GB 8408,design documents, etc.)	Test method	Description
1	Electrical control systems	4.1.2i), the related requirements of GB 8408	Test and measurement	—
2	Quality assurance of materials (including standard mechanical and electrical products, electronic components)	4.1.3	Visual inspection,record of quality inspection, material certificates etc.	The water slide device shall comply with the requirements of 4.1.3, 4.2.1.2.1,4.2.1.2.2
3	Anticorrosion,antirust	4.1.4,4.2.1.3b)	Visual inspection	
4	Outgoing quality assurance documents and materials	4.1.5	Review of quality assurance materials	Applicable to large-scale water amusement ride
5	Nameplate	4.1.6	Visual inspection	
6	Base	4.1.7	Visual test and acceptance inspection report of third party	
7	Quality of ornaments and others	4.1.8	Visual inspection, fastening tools	
8	Safety of the place possibly accessible by riders	4.1.9	Visual test, hand test	
9	Appearance quality of equipment	4.1.10	Visual inspection	
10	Appearance quality of welding	4.1.11	According to the requirements of GB/T 34370.2	-

Table 3 (continued)

S.N	Inspection items	Inspection basis (clauses in this standard,GB 8408,design documents, etc.)	Test method	Description
11	Connection between bolt and pin	4.1.12	Visual inspection, fastening tools	The bolted connection of water slide shall meet the requirement of 4.2.1.4.
12	Appearance quality of parts	4.1.13	According to the requirements of GB/T 34370.2	
13	The noise having effect on the surrounding environment	4.1.14	Sense and sound level meter	According to the requirements of GB/T 3096
14	Effect on water quality and environment	4.1.15	Visual inspection	
15	Pavement antiskid	4.1.16	Feeling, test	
16	Safety notice, warning sign, etc	4.1.17	Visual inspection	
17	Emergency rescue tools and communication equipment	4.1.18	Visual inspection,test	
18	Shower-disinfection and disinfection pool	4.1.19	Visual inspection,test	
19	Setting of water outlet opening of water circulation system	4.3.5.1	Visual inspection,test	
20	Eearthing resistance	The related requirements of GB 8408	Inspection, testing	
21	Insulation resistance	The related requirements of GB 8408	Inspection, testing	

6.1.2.2 Special inspection of water amusement equipment

Special inspection of various Categories of water amusement equipment shall be taken in accordance with the following requirements:

- a) Test for water slide device

Test items, basis and methods for water slide device are shown in Table 4

Table 4 Test Items, Basis and Methods for Water Slide Device

S.N	Inspection items	Inspection basis(clauses in this standard,GB 8408,design documents, etc.)	Test method
1	Mechanical property of fabric-reinforced plastic part of water slide	4.2.1.2.2b)	Test standards for mechanical property such as GB/T 1447, GB/T 1449 and GB/T 1451 have provided corresponding test methods,

			and qualified inspection (test) report shall be offered when the above standards are followed.
2	Structure dimension of water slide	4.2.1.2.2c)d)and design documents	Diastimeter and tape measure
3	Surface of water slide	4.2.1.2.2e),4.2.3.1	Visual test, hand test and vernier caliper measurement
4	Entrance to water slide or ladder	4.2.3.2.1	Visual test, tape measure, site test
5	Starting platform	4.2.3.2.2	Visual test, tape measure, site test

Table 4 (continued)

S.N	Inspection items	Inspection basis(clauses in this standard,GB 8408,design documents, etc.)	Test method
6	Welding quality of structural support Non-destructive testing of welding	4.2.3.2.3c)	Relevant requirements of GB/T 34370.3 and GB/T 34370.4 are followed; b) 20% samples are extracted for test according to different Categories of critical welds. If the non-qualified rate of each Category of samples is more than 5%, the number of samples shall be to 40% for test
7	Starting position	4.2.3.3	Visual increased test, tape measure
8	Slide proper	4.2.3A	Visual test, vernier caliper measurement, hand test, site trial run, radar speed indicator for velocity measurement
9	Ending part	4.2.3.5	Visual test, tape measure and trail run
10	Exit passageway	4.2.3.6	Visual inspection
11	Accessories and auxiliary facilities (including guard board, cover plate, protective screening, slide raft, rider mechanical release device and raft conveyor)	4.2.3.7.1 4.2.3.7.2a)b), 4.2.3.7.3,4.2.3.7.4, 4.2.3.7.5	Visual test, hand test, vernier caliper measurement and trial run
12	Clearance zone	4.2.3.8	Tape measure, visual test
13	Water supply (including setting of water volume and online flow monitoring)	4.2.3.9b)c)d)	Visual measurement, flowmeter and trail run
14	Control of mutual interference among riders (including spacing, warning and interlock	4.2.3.10a)b)	Visual test, trail run and emergency stop test

	control)		
15	Additional safety technical requirements	4.2.3.11b)	Visual inspection,test
16	Structure dimensions of splashdown area	Design documents	Diastimeter and tape measure

b) Test for recreation pool

Test items, basis and methods for recreation pool are shown in Table 5

Table 5 The inspection items, basis and method of amusement pool

S.N	Inspection items	Inspection basis(clauses in this standard,GB 8408,design documents, etc.)	Test method
1	Water depth	4.3.2	Measuring with tape
2	Rafting River	4.3.3	Tape measure, visual test, trail drifting and second chronograph
2.1	Flow rate	4.3.3.1	Drifting test, second chronograph and tape measure and so on
2.2	Width	4.3.3.2	Measuring with tape

Table 5 (continued)

S.N	Inspection items	Inspection basis(clauses in this standard,GB 8408,design documents, etc.)	Test method
2.3	Safety of plug flow device, waving and auxiliary facilities	4.3.3.3	Visual inspection
3	Waving pools	4.3.4	Visual inspection,tape,test
3.1	Wave height	4.3.4.1	Measuring with tape, test
3.2	Emergency stop button	4.3.4.2	Field test
3.3	Safety fence of wave outlet, isolation device of deep water area and warning sign	4.3.4.3	Visual inspection
3.4	Safety isolation device around vacuum valve	4.3.4.4	Visual inspection
4	Safety of pool wall, pool edge and bottom of pool	4.3.5.2,4.3.5.3	Visual inspection,handle
5	Separate setting of all pools	4.3.5.4	Visual inspection
6	Sign of water depth	4.3.5.5	Visual inspection
7	Monitoring sentinel at high position	4.3.5.6	Visual inspection
8	Illumination of water surface	4.3.5.8	Visual test and illuminometer
9	Water quality	4.3.5.9	Testing meter for

			residual chlorine and sampling and submission
10	Structure dimensions of pool body	Design documents	Measuring with tape

c) Inspection for interactive aquatic play structure

The inspection items, basis and method of interactive aquatic play structure are shown in Table 6.

Table 6 The inspection items, basis and method of interactive aquatic play structure

S.N	Inspection items	Inspection basis(clauses in this standard,GB 8408,design documents, etc.)	Test method
1	Safe envelope	4.4.1	Measuring with tape
2	Connection between structures	Design documents	Measuring with tape
3	Safety of net (bridge) and hanging bridge between units	4.4.2	Visual inspection,test
4	The platform, stair and railing	4.4.3	Visual inspection,handle
5	Water slide device	4.4.4	Visual inspection,handle,tape,test
6	Non-destructive test for welding quality of welding shaft of water skip bucket	4.4.5	Refer to the requirements of Table 4 and No. 6
7	Jet type equipment	4.4.6	Visual inspection,test
8	Swinging type equipment	4.4.7	Visual inspection test
9	Structures and parts involved in personal safety	4.4.8	Visual inspection,test and inspection

d) Testing of whitewater rafting

d) The inspection items, basis and method of whitewater rafting are shown in Table 7.

Table 7 The inspection items, basis and method of whitewater rafting

S.N	Inspection items	Inspection basis(clauses in this standard,GB 8408,design documents, etc.)	Test method
1	Video monitoring device	4.5.1	Visual inspection
2	Safety of pump station	4.5.2	Measuring and visual inspection with tape
3	Safety of lifting system	4.5.3	Visual inspection,test
4	Control of water volume and water depth	4.5.4	Visual inspection,tape
5	Structure dimensions and safety of waterway	4.5.5 Design documents	Visual inspection,tape
6	Drifting boat	4.5.6^4.5.7	Visual inspection,tape,test
7	Drifting running test	4.5.8	Visual inspection,test
8	Failure of automatic control interlocking at the dispatching section of whitewater rafting	4.5.9	Visual inspection,test

e) Test for leisure boat

Test items, basis and methods for leisure boat are shown in Table 8

Table 8 Test items, basis and methods for leisure boat

S.N	Inspection items	Inspection basis(clauses in this standard,GB 8408,design documents, etc.)	Test method
1	Structural strength and test	4.6.6,4.6.7,5.5.2	Test
2	Stability	4.6.8,5.5.4	Visual inspection,test
3	Hull water proof	4.6. 9. 5.5 Shock	Visual inspection,test
4	Anti-collision control and suspension ring device	4.6.10	Visual inspection,tape,test
5	Joystick and pedal crank	4.6.11	Visual inspection,test
6	Joystick of powered boats	4.6.12	Test
7	Handrail	4.6.13	Visual inspection,test
8	Reliability and speed	4.6.14,5.5.5	Visual inspection,test
9	Structure dimensions	4.6.15 Design documents	Visual inspection,tape,vernier caliper
10	Power boat	4.6.16	Test,visual inspection
11	Isolation of transmission device of power boat	4.6.17	Visual inspection
12	Protection device for main circuit of battery boat and its voltage	4.6.18	Visual inspection,test
13	Working time measurement of battery boat	4.6.19,5.5.6	Visual inspection,test
14	Safety test	5.5.1	Test

6.2 Judgment rules

6.2.1 The defect of facilities inconsistent with standard stipulations is divided into serious defect and general defect. The defect affecting safety of riders is serious defect while the others are called as general defect. Product items with serious defects are shown in Table 9. For each facility, there is one (including the one) serious defect or three general defects (including the third one) being unqualified.

6.2.2 The unqualified products shall reach the requirements of qualified ones after rework (repair).

Table 9 Serious defective item of product

S.N	Contents of defects	Standard clauses
1	Residual current operated protective devices	4.1.20
2	Safety warning sign and other do not conform to the requirements	4.1.17,4.3.4.3,4.3.5.1
3	The safety of the place possibly accessible for riders does not conform to the requirements	4.1.9
4	The safety of surface of summer toboggan run does not conform to the requirements	4.2.3.1b) c)
5	Important welds does not conform to the requirements	4.2.3.2.3c) ,4.4.5
6	Safety performance of slide proper does not conform to the requirements	4.2.3.4a)
7	The safety of riders at the ending part of water slide does	4.2.3.5.2a),4.2.3.5.3a) f)

	not conform to the requirements	
8	Clearance zone does not conform to the requirements	4.2.3.8
9	The setting of water outlet opening of water circulation system does not conform to the requirements	4.3.3.4,4.3.5.1
10	The wave outlet of waving pool, safety fence of deep water area and isolation device do not conform to the requirements	4.3.4.3
11	Important welds does not conform to the requirements	4.3.5.2
12	Structures and parts of involved in personal safety in water attraction complex	4.4.8
13	The safety of lifting system of whitewater rafting does not conform to the requirements	4.5.3
14	Failure of automatic control interlocking at the dispatching section of whitewater rafting	4.5.9
15	Lack of stability of boat, water leakage of hull and excessively fast boat speed	4.6.8,4.6.9,4.6.14,5.5.4
16	Insulation resistance does not conform to the requirements	The related requirements of GB 8408
17	Eearthing resistance does not conform to the requirements	The related requirements of GB 8408

Annex A

(Informative)

Category of Water Slide Device and Typical Cross-Section Shape

A.1 General

The cross-section shapes listed in this Appendix are relatively typical and common forms of cross section of water slide, impossibility covering all forms. Therefore, the cross-section shapes of water slide shall not be necessarily consistent with the diagram of this Appendix.

A.2 Category of water slide device and typical cross-section shape

A.2.1 Category 1

a) Main technical parameters: straight single slide with 70% maximum inclination and height below 3 m. Such as children's straight slide.

b) See Figure A.1 for cross-section shape in detail.

c) Description:

1) $H \geq 120$ mm, 350 mm $\leq X \leq 700$ mm (uses by single), or $X \geq 950$ mm (used by multiple).

2) See Figure A.3 c) for the cross-section shape of enclosed water slide in detail, and its radius shall be more than 750 mm.

3) It is generally suitable for the children under 1.2 m.

A.2.2 Category 2

a) Main technical parameters: single slide with 11%-18% average inclination and height below 3 m. Such as children's curve slide and children's straight slide.

b) See Figure A.2 for cross-section shape.

c) Explain:

1) $H \geq 450$ mm, 350 mm $\leq X \leq 700$ mm.

2) See Figure A.3 c) for the cross-section shape of enclosed water slide in detail, and its radius shall be more than 750 mm.

3) It is generally suitable for the children under 1.2 m.

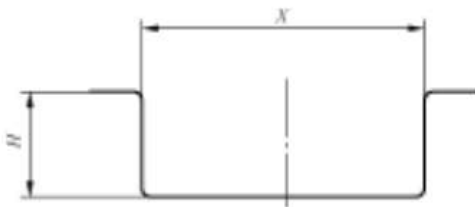


Figure A.1 Cross Section of Category 1

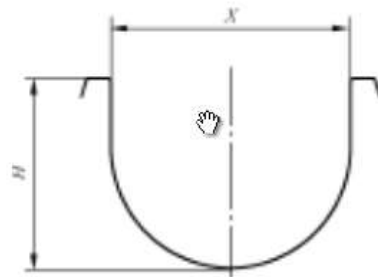


Figure A.2 Cross Section of Category 2

A.2.3 Category 3

a) Main technical parameters: single summer toboggan run with 13 % maximum inclination, unrestricted height, 5 m/s average speed and 8 m/s maximum speed. Such as straight and

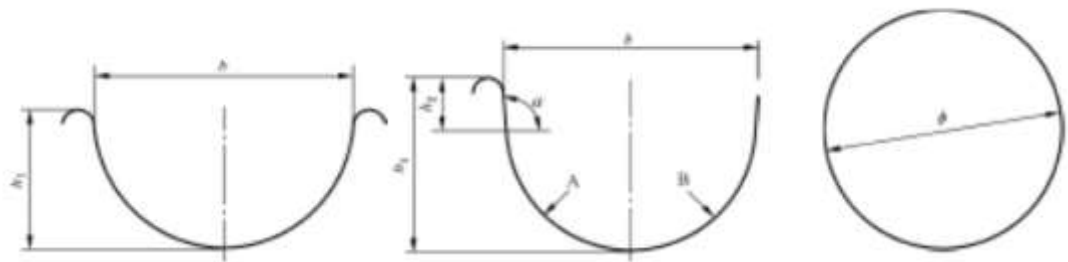
- curve water slides.
- b) See Figure A.3 and Figure A.4 for cross-section shape in detail.
- c) Explain:

- 1) $a \leq 95^\circ$; $b \geq 800$ mm; $h_2 \geq 200$ mm; $\phi \geq 800$ mm.
- 2) $h_1 \geq 600$ mm.
- 3) The one shown in Figure A.4 can only be made into straight water slide.
- 4) The position A in Figure A.3 refers to the outboard curved surface at the time of sliding on the water slide; the position B shown herein refers to inboard curved surface or straight surface at the time of sliding on the water slide.

A.2.4 Category 4

- a) Main technical parameters: intermediate speed single slide with 13%-20% average inclination, unrestricted height, 10 m/s average speed and 16 m/s maximum speed. Such as straight and curve slides.
- b) See Figure A.3 and Figure A.4 for cross-section shape in detail.
- c) Description:

- 1) $a \leq 95^\circ$; $b \geq 800$ mm; $h_2 \geq 200$ mm; $\phi \geq 800$ mm.
- 2) $h_1 \geq 700$ mm.
- 3) The one shown in Figure A.4 can be only made into straight slide.
- 4) The position A shown in Figure A.3 refers to outboard curved surface at the time of sliding on the water slide; the position B shown herein refers to inboard curved surface or straight surface at the time of sliding on the water slide.
- 5) With regard to the intermediate speed curve slide, close attention shall be paid to the design of curve part after obvious acceleration.



a) Open curve slide

b) Open curve slide

c) Cross section of enclosed slide

Cross section of straight-line section or cross section of straight slide

Cross section of curve section

Figure A.3 Cross Sections of Category 3 and Category 4

A.2.5 Category 5

- a) Main technical parameters: high-speed single slide with average inclination being more than 20%, unrestricted height and speed being more than 16 m/s. Such as straight and enclosed curve slides.
- b) See Figure A.3 and Figure A.4 for cross-section shape in detail.

- c) Explain:
- 1) The cross-section shape is the straight slide with flat base shown in Figure A.4, $b \geq 600$ mm; $h \geq 400$ mm; $R \geq 40$ mm; $a \leq 120$.
 - 2) The cross-section shape is the straight slide with curved base, and its section shall be consistent with that shown in Figure A.3 a).
 - 3) If it is a curve slide, an enclosed water slide shall be made, and its cross-section form shall be consistent with that in Figure A.3 c), $\phi \geq 800$ mm.

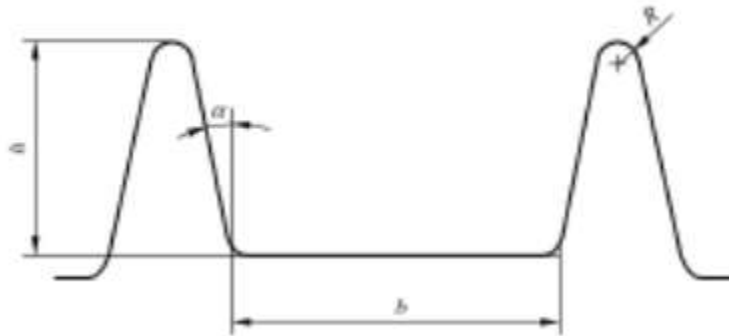


Figure A.4 Cross Section of Category 5

A.2.6 Category 6.1

- a) Main technical parameters: the slide with several straight lines or curves parallel and same with the form of Category 3, with same or similar length, 5 m/s average speed and 8 m/s maximum speed. Such as parallel straight slide and parallel curve slide (combination of several slides).
- b) See Figure A.3 and A.5 for cross-section shape in detail.
- c) Explain:

- 1) $600 \text{ mm} \leq b_1 \leq 1800 \text{ mm}$; $h_1 \geq 500 \text{ mm}$; $b_2 \geq 150 \text{ mm}$; $h_2 \geq 200 \text{ mm}$.
- 2) The cross-section shape of the parallel curve slide combination shall be consistent with Category 3 in Figure A.3.
- 3) The cross-section shape of the combination of multiple straight slides shall be consistent with that in Figure A.5.

A.2.3 Category 6.2

- a) Main technical parameters: the slide with several straight lines or curves parallel and same with the form of Category 4, with same or similar length, 10 m/s average speed, 16 m/s maximum speed. Such as gallop racing slide (combination of multiple slides).
 - b) See Figure A.3 and A.5 for cross-section shape in detail.
 - c) Explain:
- 1) $600 \text{ mm} \leq b_1 \leq 1800 \text{ mm}$; $h_1 \geq 500 \text{ mm}$; $b_2 \geq 150 \text{ mm}$; $h_2 \geq 200 \text{ mm}$.
 - 2) The cross-section shape of the parallel curve slide combination shall be consistent with Category 3 in Figure A.3.
 - 3) The cross-section shape of the combination of multiple straight slides shall be consistent with Figure A.5.

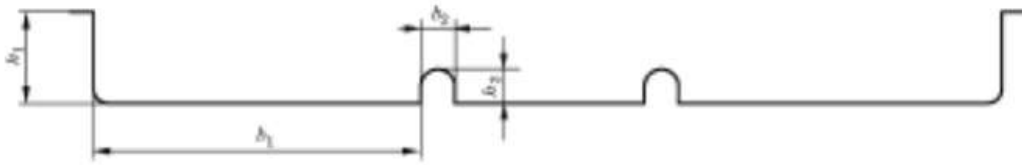


Figure A.5 Cross section of Category 6.1 and Category 6.2

A.2.8 Category 7

- a) Main technical parameters: 35% maximum gradient, running height lower than or equaling to 8 m, 8 m/s maximum speed. Such as family wide slide.
- b) See Figure A.6 for cross-section shape in detail.
- c) Explain:
 $b \geq 1500 \text{ mm}$; $h \geq 500 \text{ mm}$; $R \leq h/2$, and $R \geq 50 \text{ mm}$.

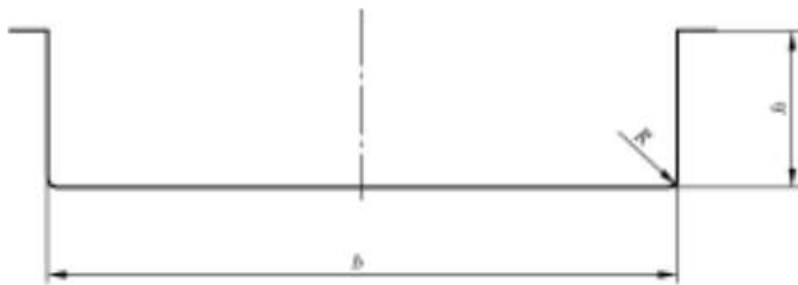


Figure A.6 Cross Section of Category 7

A.2.9 Category 8

Category A.2.9.1 Category 8 is the special water slide, combined by Category 3-Category 7 and other water slide devices with different structural forms and section shapes, with different experience effects. Such slide is generally inner tube water slide, with rated carrying capacity being more than 2 persons/time/boat, typical products and structural Categories have big trumpet slide, boomerang slide, water roller coaster and behemoth bowel slide series.

A.2.9.2 Structure and running feature of big trumpet slide series:

- a) The main body part of the slide is generally a circular cylinder body spliced by several slightly cambered trapezoidal or irregular-shaped fabric-reinforced plastic plates, being used to be called “big trumpet”, and acts as one of main parts of amusement experience of riders.
- b) Its running feature is that riders start from curve or straight slide by raft, and enter into the trumpet at certain inclined angle after going through the acceleration section of gravity, and swing and move to the ending part depending on the conversion of kinetic energy and potential energy several times and finish the slide.
- c) Similar products include python slide, storm valley slide and small trumpet slide.

A.2.9.3 Structure and running feature of boomerang slide series:

- a) The main body of the slide is generally a slide plate structural body with the “U-type” section shape spliced by several slightly cambered rectangular or irregular-shaped fabric-reinforced plastic plates, acting as one of main parts of amusement experience of

riders.

b) Its running feature is that riders start from curve or straight slide by raft, and enter into the “wave valley” of corrugated slide plate at certain inclined angle after going through the acceleration section of gravity, and are pushed to upper position of slide plate depending the conversion of kinetic energy and potential energy and then slip into the “wave valley” again, and then enter into the ending part and finish the slide.

c) The boomerang slide is also known as big slide plate, U-type slide plate, and slope crossing slide. Similar products include waving slide, and cobra slide.

A.2.9.4 Structure and running feature of water roller coaster series:

a) The main body structure of slide is similar to Category 4, its features is to push riders from the low position of slide to high position depending on specific auxiliary thrust function, and then make riders fall into next low position depending on gravity.

b) Its running feature is that riders slip into “wave valley” depending on gravitational potential energy and are pushed to a “wave peak” and complete a “stroke” depending on kinetic energy and the function of auxiliary thrust device, which is similar to the running track of “roller coaster”, generally, the riders enter into ending part and finish the slide after several continuous strokes.

c) The water roller coaster is commonly known as “water dragon”.

A.2.9.5 Structure and running feature of behemoth bowel slide series:

a) The main body part of slide is generally the “bowel-shape” structure spliced by several curved plates with “watermelon peel” shape and trapezoidal boards in a specified order, acting as one of main parts of amusement experience of riders.

b) Its running feature is that riders start from curve or straight slide by raft, and plunge into the “bowel-shape” structure after going through the acceleration section of gravity, and then slide rotationally along the rim of “bowel”, and enter into the ending part via the bottom of “bowel” after the attenuation of gravity several times, and then finish the slide.

c) The behemoth bowel slide is also known as “super bowel slide” and “big bowel slide” and so on, and similar products include space basin slide.

Annex B

(Informative)

Calculation Example of Slide load of Rider, the Maximum Acceleration of Slide and Centrifugal Force of Slide of Rider

B.1 Slide load of riders

The slide load of riders in water slide can be estimated according to the data of Table B.1, and test is required when necessary.

Table B.1 Slide load of riders

Slide Category	Slide load of rider	Length of load m	Common calculation speed (m/s)	Data related to calculation of centrifugal force			
				Speed of rider/ (m/s)	Length of action m	Position of action point mm	Function direction of force
1	0.8 kN/m	—	—	—	—	—	—
2	0.8 kN/m	5.0	3.5	3.5	5.0	100	Horizontal
3	1.5 kN/m	5.0	8.0	3.5/(7.0) ^a	5.0/(1.0) ^a	0.100	Vertical / horizontal
4	1.5 kN/m	1.0	14	14	1.0	0.350	Vertical / horizontal
5	1.5 kN/m	1.0	16	16	1.0	0.350	Vertical / horizontal
6.1	1.5 kN/m	5.0	8.0	3.5/(8.0) ^a	5.0/(1.0) ^a	0.100	Vertical / horizontal
6.2	1.5 kN/m	1.0	14	14	1.0	0.350	Vertical / horizontal
7	1.5 kN/m ²	5.0	8.0	8.0	5.0	0	Vertical
8	—	—	—	—	—	—	—
<p>Note 1: The values of relevant parameters of Category 8 shall be obtained according to its specific condition and relevant data of Category 1-Category 7.</p> <p>Note 2: Refer to Figure B.1 for the position of action point.</p> <p>^a Requirements that shall be satisfied for single slide</p>							

B.2 Maximum acceleration when riders slide

Refer to Table B.2 for the maximum acceleration control when riders slide.

Table B.2 Maximum slide acceleration

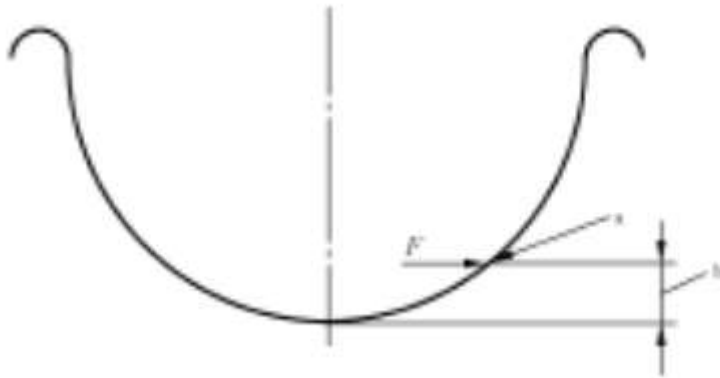
Maximum slide acceleration	Duration/s
≤4 g	<0.1
≤2.6 g	≥0.1
注: g=Acceleration of gravity; 1g=9.8 m/s ² .	

B.3 Calculation example of centrifugal force when riders slide

The centrifugal force when riders slide shall be calculated and listed as follows:

——It shall be calculated through referring to the data of No. 5 (Category 5) in Table B.1 (refer to Annex A for Category of slides)

- Slide load of rider 1.5kN/m, horizontal direction;
- Speed of rider $v = 16 \text{ m/s}$;
- Length of action 1m, radial;
- Turning radius $r = 10 \text{ m}$;
- Centrifugal acceleration $a = v^2/r = 16^2/10 = 25.6 \text{ m/s}^2 = 2.56 g < 2.6 g$;
- Centrifugal force $Q_9(F) = \text{proportionality factor of acceleration} \times \text{slide load of rider} = 2.56 \times 1.5 \text{ kN/m} = 3.84 \text{ kN/m}$;



Key:

F—Means centrifugal force;

a—Means action point of force

The height difference between the action point of force and bottom of summer toboggan run, being 100 mm-350 mm in general.

Figure B.1 Confirmation of Curvature Radius of Centrifugal Force and Centrifugal Force