

SINGAPORE STANDARD**Specification for playground equipment for
public use**

This Singapore Standard is based on ASTM F 1487, Copyright ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428, USA. Reprinted by permission of ASTM International.

Published by

**Enterprise
Singapore**

SS 457 : 2017
(ICS 97.200.40)

SINGAPORE STANDARD

**Specification for playground equipment for public
use**

All rights reserved. Unless otherwise specified, no part of this Singapore Standard may be reproduced or utilised in any form or by any means, electronic or mechanical, including photocopying and microfilming, without permission in writing from Enterprise Singapore. Request for permission can be sent to: standards@enterprisesg.gov.sg.

ISBN 978-981-47-8465-8

This Singapore Standard was approved by the Quality and Safety Standards Committee on behalf of the Singapore Standards Council on 30 November 2017.

First published, 1999
First revision, 2007
Second revision, 2017

The Quality and Safety Standards Committee, appointed by the Standards Council, consists of the following members:

	Name	Capacity
Chairman	: Er. Go Heng Huat	<i>Individual Capacity</i>
Deputy Chairman	: Mr Seet Choh San	<i>Singapore Institution of Safety Officers</i>
Advisor	: Mr Chan Yew Kwong	<i>Individual Capacity</i>
Secretary	: Ms Kong Wai Yee	<i>Singapore Manufacturing Federation – Standards Development Organisation</i>
Members	: Er. Goh Keng Cheong	<i>Housing & Development Board</i>
	Er. Hashim Bin Mansoor	<i>Building and Construction Authority</i>
	Assoc Prof Hoon Kay Hiang	<i>Nanyang Technological University</i>
	Mr Koh Yeong Kheng	<i>Association of Small and Medium Enterprises</i>
	Mr Lee Kay Chai	<i>Singapore Contractors Association Limited</i>
	Prof Lee Pui Mun	<i>Singapore University of Social Sciences</i>
	Mr Lim Kee Huat/Mr Liow Kin Lian	<i>Society of Loss Prevention in the Process Industries</i>
	Mr Steven Nah	<i>Association of Process Industry</i>
	Mr Ong Liong Chuan	<i>Individual Capacity</i>
	Mr Perianan Radhakrishnan	<i>Singapore Welding Society</i>
	Assoc Prof Simon Poh Siew Beng	<i>National University of Singapore</i>
	Mr Derek Sim	<i>Association of Singapore Marine Industries</i>
	Mr Harnek Singh	<i>Individual Capacity</i>
	Mr Birch Sio	<i>Singapore Manufacturing Federation</i>
	Mr Alvin Soong Kheng Boon	<i>Land Transport Authority</i>
	Mr Tan Kay Chen	<i>The Institution of Engineers, Singapore</i>
	Mr Daniel Tan Kuan Wei	<i>Individual Capacity</i>
	Mr Ronald Tan	<i>Singapore Productivity Association</i>
	Mr Jonathan Wan	<i>Individual Capacity</i>
	Mr Wong Siu Tee	<i>JTC Corporation</i>
	Mr Winston Yew	<i>Workplace Safety and Health Council</i>

The Technical Committee on Personal Safety and Health, appointed by the Quality and Safety Standards Committee and responsible for the preparation of this standard, consists of representatives from the following organisations:

	Name	Capacity
Co-Chairmen	: Assoc Prof Chew Chye Heng	<i>Individual Capacity</i>
	Mr Winston Yew	<i>Individual Capacity</i>
Secretary	: Ms Julia Yeo	<i>Singapore Manufacturing Federation – Standards Development Organisation</i>
Members	: Mr Bhupendra Singh Baliyan	<i>The Institution of Engineers, Singapore</i>
	Mr Thomas Fong	<i>Singapore Contractors Association Limited</i>
	Mr Patrick Ker	<i>Singapore Association of Occupational Therapists</i>
	Mr Lim Cheong	<i>Ministry of Manpower</i>
	Mr Seah Chong An	<i>TÜV SÜD PSB Pte Ltd</i>
	Mr Seah Liang Bing	<i>Singapore Institution of Safety Officers</i>
	Mr Derek Sim	<i>Association of Singapore Marine Industries</i>
	Mr Edwin Yap	<i>Human Factors and Ergonomics Society of Singapore</i>
	Mr Yussoof Aynuddin	<i>SETSCO Services Pte Ltd</i>

The Working Group on SS 457, appointed by the Technical Committee to assist in the preparation of this standard, comprises the following experts who contribute in their *individual capacity*:

	Name
Convenor	: Mr Wong Wei Jue
Members	: Mr Kenneth S Kutska
	Mr Jimmy Lee Shen Sun
	Mr Derek Loei
	Ms Berni Ong
	Mr Jason Sim
	Mr Soo Kwok Meng
	Dr Sun Qiqing
	Ms Alisa Wee Huili
	Ms Yoon Hui Lian
Resource Members	: Ms Lauw Sok Chin
	Ms Nur Khairiana

The organisations in which the experts of the Working Group are involved are:

EM Services Pte Ltd
Health Promotion Board
Housing & Development Board
International Playground Safety Institute
National Parks Board
Playpoint (Singapore) Pte Ltd
Singapore Laboratory Services Pte Ltd
TÜV SÜD PSB Pte Ltd

(blank page)

Contents

	Page
National Foreword _____	8
0 Introduction _____	9
1 Scope _____	9
2 Referenced documents _____	11
3 Terminology _____	12
4 Materials and manufacture _____	18
5 General requirements _____	19
6 Performance requirements _____	19
7 Requirements for access/egress _____	25
8 Equipment _____	29
9 Playground layout _____	41
10 Accessibility _____	45
11 Installation _____	45
12 Structural integrity _____	45
13 Maintenance _____	49
14 Signs or labels, or both _____	50
15 Manufacturer identification _____	50
16 Keywords _____	51

Annex

ZA National deviations _____	102
------------------------------	-----

Tables

1 Minimum acceptable distance from an opening to a crush or shear point _____	24
2 Rung ladders, stepladders, stairways, and ramps (access slope; tread, rung, and ramp width; tread depth; rung diameter; and vertical rise, by age of intended user) _____	25

Figures

A1.1 Exemption from head and neck entrapment requirements _____	52
A1.2 Torso probe _____	53
A1.3 Head probe _____	54
A1.4 Test template for partially bounded openings _____	55
A1.5 Inserting the template into the opening _____	56
A1.6 Test template for partially bounded openings _____	57
A1.7 Exemption for a thick surface condition using the “B” portion of the test template _____	58
A1.8 Template test _____	59

A1.9	A partially bounded opening is not considered accessible if the template cannot penetrate the opening to a depth greater than 0.75 in. (19.1 mm) (thickness of the test template) _____	60
A1.10	Projection test gauges _____	60
A1.11	Projection test gauge for suspended swing assemblies _____	61
A1.12	Compound projection test _____	61
A1.13	Use of projection gauges _____	62
A1.14	Area subject to the requirements of 6.4.1 _____	63
A1.15	Entanglement test requirements examples _____	64
A1.16	Entanglement test requirements examples continued _____	66
A1.17	Entanglement test requirements examples _____	66
A1.18	Entanglement test requirements examples _____	67
A1.19	Requirements for fastening devices _____	68
A1.20	Accessibility probe _____	69
A1.21	Adjacent platforms _____	69
A1.22	Height/length ratio of sliding surfaces _____	70
A1.23	Formula for minimum vertical sidewall height _____	70
A1.24	Formula for minimum vertical sidewall height _____	71
A1.25	Slide exit requirements _____	71
A1.26	Height of slide exit region and slide bedway length _____	71
A1.27	Slide and spiral slide clearance _____	72
A1.28	To/fro swings _____	73
A1.29	Rotating (multiple axis) swings _____	73
A1.30	Example of ring ladder _____	74
A1.31	Minimum and maximum radii of noncircular rotating equipment _____	74
A1.32	Use zones for stationary equipment _____	75
A1.33	Use zones for rotating equipment _____	76
A1.34	Use zones for to-fro swings _____	77
A1.35	Use zones for to-fro swings "T" swings with open seats _____	78
A1.36	Use zones for to-fro swings with fully enclosed swings seats _____	79
A1.37	Use zones for to-fro swings "T" swings with fully enclosed seats _____	80
A1.38	Use zones for rotating swings _____	81
A1.39	Use zones for rocking/springing equipment _____	82
A1.40	Use zones for slides _____	83
A1.41	Overlap of parallel of diverging slide paths (pass) _____	84
A1.42	Slide exit clearance _____	84
A1.43	Overlap of converging slide paths (fail) _____	85
A1.44	Composite play structure _____	86
A1.45	Placement of equipment _____	86

A1.46	Ramps intended for wheelchair use _____	87
A1.47	Transfer point and return on a wheelchair accessible platform _____	88
A1.48	Minimum clear width _____	89
A1.49	Wheelchair accessible platforms _____	89
A1.50	Horizontal rings and ladders _____	90
A1.51	Load distribution devices _____	91
A1.52	Hanging ring and hanging rung-dimensional details _____	92
A1.53	2-dimensional grids and 3-dimensional matrix nets _____	92
A1.54	Climbing net clear opening _____	93
A1.55	Fall heights for 3-dimensional matrix nets _____	94
A1.56	Fall heights for 3-dimensional matrix nets _____	95
A1.57	Fall heights for 3-dimensional matrix nets _____	96
A1.58	Overhead obstructions _____	97
A1.59	Use zone of combination swings _____	98
A1.60	Swing impact test device arrangement _____	99
A1.61	Clearance for rotating equipment with a reducing plane of motion _____	99
A1.62	Clearance zone for rotating equipment _____	100
A1.63	Embankment slide _____	101

National Foreword

This Singapore Standard was prepared by the Working Group on Playground Equipment for Public Use, appointed by the Technical Committee on Personal Safety and Health under the direction of the Quality and Safety Standards Committee.

This standard is a revision of SS 457 : 2007, "Specification for playground equipment for public use". It is based on ASTM F1487-17, Standard Consumer Safety Performance Specification for Playground Equipment for Public Use, Copyright ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428, USA. Reprinted by permission of ASTM International.

The modifications (national deviations) to suit local requirements and the needs of the industry are given in Annex ZA. The changes in the main text are indicated with lines along the margins.

The summary of changes from the 2007 edition is as follows:

- (a) Revision to the scope and definitions;
- (b) Revision to the performance requirements, requirements for access and egress, playground layout, maintenance and installation;
- (c) Inclusion of embankment slides, vertical rotating equipment and horizontal rotating equipment;
- (d) Additional figures.

The revision brings the standard up-to-date and makes it more comprehensive by incorporating recommendations made in the latest ASTM F 1487.

In preparing this standard, reference was made to the Code on accessibility in the built environment, Building and Construction Authority.

Acknowledgement is made for the use of information from the above publications.

Attention is drawn to the possibility that some of the elements of this Singapore Standard may be the subject of patent rights. Enterprise Singapore shall not be held responsible for identifying any or all of such patent rights.

NOTE

1. *Singapore Standards (SSs) and Technical References (TRs) are reviewed periodically to keep abreast of technical changes, technological developments and industry practices. The changes are documented through the issue of either amendments or revisions.*
2. *An SS or TR is voluntary in nature except when it is made mandatory by a regulatory authority. It can also be cited in contracts making its application a business necessity. Users are advised to assess and determine whether the SS or TR is suitable for their intended use or purpose. If required, they should refer to the relevant professionals or experts for advice on the use of the document. Enterprise Singapore shall not be liable for any damages whether directly or indirectly suffered by anyone or any organisation as a result of the use of any SS or TR.*
3. *Compliance with a SS or TR does not exempt users from any legal obligations.*

Specification for playground equipment for public use¹

0 Introduction

0.1 This consumer safety performance specification establishes nationally recognized safety standards for public playground equipment to address injuries identified by the U.S. Consumer Product Safety Commission (CPSC).

0.2 During 1999 the CPSC estimated that about 156 000 victims were treated in U.S. hospital emergency rooms for injuries associated with public playground equipment. About three fourths of these injuries resulted from falls, primarily to the surface on which the equipment was located. Other hazard patterns involved impact by swings and other moving equipment and contact with protrusions, crush or shear points, and sharp edges. Fatalities reported to the CPSC resulted from falls; entanglement of clothing or similar items on equipment; entanglement in ropes tied to or caught on equipment; head entrapment; impact by equipment that tipped over or otherwise failed; and impact by moving swings. This consumer safety performance specification does not eliminate the need for supervision of children on public playground equipment. It is intended to minimize the likelihood of life-threatening or debilitating injuries, such as those identified by the CPSC.

0.3 There has been significant harmonization of this performance specification and CAN/CSA-Z614.

1 Scope

1.1 This consumer safety performance specification provides safety and performance standards for various types of public playground equipment. Its purpose is to reduce life-threatening and debilitating injuries.

1.2 The range of users encompassed by this consumer safety performance specification is the 5th percentile 2-year-old through the 95th percentile 12-year-old.

1.3 Home playground equipment, toys, amusement rides, sports equipment, fitness equipment intended for users over the age of 12, public use play equipment for children 6 to 24 months, and soft contained play equipment are not included in this specification.

1.4 Products or materials (site furnishings) that are installed outside the equipment use zone, such as benches, tables, independent shade structures, and borders used to contain protective surfacing, are not considered playground equipment and are not included in this specification.

1.5 This specification does not address accessibility, except as it pertains to safety issues not covered in the DOJ 2010 Standard for accessible design.

¹ This consumer safety performance specification is under the jurisdiction of ASTM Committee F15 on Consumer Products and is the direct responsibility of Subcommittee F15.29 on Playground Equipment for Public Use.

1.6 This consumer safety performance specification includes the following sections:

Title	Section number
Scope	1
Referenced documents	2
Terminology	3
Materials and manufacture	4
General requirements	5
Performance requirements	6
Requirements for access/egress	7
Equipment	8
Playground layout	9
Accessibility	10
Installation	11
Structural integrity	12
Maintenance	13
Signs or labels, or both	14
Manufacturer identification	15
Keywords	16
Figures	Annex A1

1.6.1 The requirements in this specification are designed to mitigate the hazards typically presented by various types of equipment. New equipment may not specifically fit into the designated types listed in the specification; however, the designer or manufacturer, or both, shall use professional judgment to perform and document a hazard analysis and follow appropriate requirements to mitigate the hazards.

1.7 General measures, tolerances, and conversions:

1.7.1 The general tolerances for this specification (unless otherwise specified) are as follows:

Dimension	Tolerance
X in.	±0.5 in.
X.X in.	±0.05 in.
X.XX in.	±0.005 in.

These tolerances still apply to a dimension even when terms like greater than, less than, minimum, or maximum are used.

1.7.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only.

1.7.3 The conversion factor from inch-pound to metric units is 1 in. = 25.4 mm, and 1 lb = 0.45359 kg.

1.7.4 See Annex A1 for figures referenced throughout this specification.

1.7.5 This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

1.8 This international standard was developed in accordance with internationally recognized principles on standardization established in the decision on principles for the development of international standards, guides and recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.

2 Referenced documents

2.1 ASTM standards²

D2240	Standard test method for rubber property – Durometer hardness
F698	Standard specification for physical information to be provided for amusement rides and devices
F846	Standard guide for testing performance of amusement rides and devices
F853	Standard practice for maintenance procedures for amusement rides and devices
F893	Standard guide for inspection of amusement rides and devices
F963	Standard consumer safety specification for toy safety
F1004	Standard consumer safety specification for expansion gates and expandable enclosures
F1148	Standard consumer safety performance specification for home playground equipment
F1159	Standard practice for design of amusement rides and devices that are outside the purview of other F24 design standards
F1292	Standard specification for impact attenuation of surfacing materials within the use zone of playground equipment
F1918	Standard safety performance specification for soft contained play equipment
F1951	Standard specification for determination of accessibility of surface systems under and around playground equipment
F2373	Standard consumer safety performance specification for public use play equipment for children 6 months through 23 months

2.2 ANSI standards³

ANSI Z535.1	Safety color code
ANSI Z535.2	Environmental and facility safety signs
ANSI Z535.4	Products safety—Signs and labels

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

³ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036.

2.3 Federal standards⁴

16 CFR Part 1303	Ban of lead-containing paint and certain consumer products bearing lead-containing paint
16 CFR 1500	Hazardous Substances Act Regulations, including sections: 1500.48 Technical requirements for determining a sharp point in toys and other articles intended for use by children under 8 years of age 1500.49 Technical requirements for determining a sharp metal or glass edge in toys and other articles intended for use by children under 8 years of age
16 CFR Section 1501	Method for identifying toys and other articles intended for use by children under 3 years of age which present choking, aspiration or ingestion hazards because of small parts
DOJ 2010	Standard for accessible design United States Department of Justice (DOJ) 2010 Standard for accessible design: Title II (28 CFR 35) and Title III (28 CFR 36) ⁵

2.4 UL standard⁶

UL 969	Standard for safety: marking and labeling systems
--------	---

2.5 CSA standard⁷

CAN/CSA-Z614	Children's playspaces and equipment
--------------	-------------------------------------

⁴ Available from U.S. Government Printing Office Superintendent of Documents, 732 N. Capitol St., NW, Mail Stop: SDE, Washington, DC 20401.

⁵ Available free at: <http://www.ada.gov/regs2010/ADAregs2010.htm>.

⁶ Available from Underwriters Laboratories (UL), Corporate Progress, 333 Pfingsten Rd., Northbrook, IL 60062.

⁷ Available from Canadian Standards Association (CSA), 178 Rexdale Blvd., Toronto, ON M9W1R3, Canada.