



Passenger ropeways and passenger conveyors



This Australian Standard® was prepared by Committee ME-051, Amusement Rides and Devices. It was approved on behalf of the Council of Standards Australia on 25 September 2018.

This Standard was published on 12 November 2018.

The following are represented on Committee ME-051:

- Attorney-General's Department South Australia
 - Australian Amusement Association
 - Australian Amusement Leisure and Recreation Association
 - Australian Ski Area Association
 - Consumers Federation of Australia
 - Department of Justice and Attorney General, Qld
 - Engineers Australia
 - Institution of Professional Engineers New Zealand
 - Kidsafe
 - Local Government New Zealand
 - Safety Institute of Australia
 - SafeWork NSW
 - Showmens Guild of Australasia
 - Worksafe Division, Department of Commerce, Western Australia
 - WorkSafe New Zealand
 - WorkSafe Victoria
-

This Standard was issued in draft form for comment as DR AS 4722:2017.

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

Keeping Standards up-to-date

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

Standards may also be withdrawn.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

Detailed information about Australian Standards, drafts, amendments and new projects can be found by visiting **www.standards.org.au**

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

Australian Standard®

Passenger ropeways and passenger conveyors

Originated as part of AS 3533—1988.
Previous editions, in part, as part of AS 3533.1—1997 and AS 3533.2—1997.
AS 3533.1—1997 and AS 3533.2—1997 revised, in part, amalgamated and redesignated as AS 4722—2009.
Second edition 2018.

COPYRIGHT

© Standards Australia Limited

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

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

ISBN 978 1 76072 228 9

PREFACE

This Standard was prepared by Committee ME-051, Amusement Rides and Devices, to supersede AS 4722—2009.

The objective of this Standard is to provide designers, manufacturers, proprietors, inspectors and operating staff with requirements and guidance specific to the design, construction, operation, inspection, testing and maintenance of passenger ropeways and passenger conveyors that will protect the health and safety of both operating staff and patrons of these devices.

This Standard references and modifies the requirements of Canadian Standards Association publication CSA Z98-14, *Passenger ropeways and passenger conveyors*. The Canadian Standard has historically been used for requirements for passenger ropeways in Australia. The Subcommittee has kept Australian variations to this Standard to a minimum and has informed the relevant Canadian committee of these so they can be considered for incorporation in a future edition of CSA Z98.

It should be noted that conformance to this Standard alone does not necessarily ensure that all legal obligations are being fulfilled.

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

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

CONTENTS

	<i>Page</i>
FOREWORD.....	4
1 SCOPE.....	5
2 REFERENCED DOCUMENTS.....	5
3 DEFINITIONS.....	7
4 CANADIAN REFERENCED DOCUMENTS	8
5 VARIATIONS TO CANADIAN REQUIREMENTS.....	8
APPENDIX KA EXAMPLE MECHANICAL SOCKET REPORT	34

FOREWORD

At present, various persons have been assigned a duty of care in the general work health and safety (WHS) legislation in Australia. This Foreword indicates how these duties can generally be interpreted and may provide an understanding of the basis for the requirements in this Standard.

Under WHS legislation, employers have a duty to ensure the safety of their employees and other people at the workplace. The operator of a passenger ropeway or conveyor has a duty to ensure that participants and others present are not exposed to risks arising from the activities. This duty includes conducting a risk assessment of the facility and its operation to consider foreseeable risks to employees, participants and others, and to implement measures to eliminate or control such risks.

Designers, manufacturers and suppliers of the structure and equipment also have duties to ensure the plant and equipment is safe and without risk when used. Additionally they need to provide information that is necessary to enable the plant to be properly used and maintained.

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

STANDARDS AUSTRALIA

Australian Standard

Passenger ropeways and passenger conveyors

1 SCOPE

This Standard sets out requirements and guidance for the design, construction, operation, inspection, testing and maintenance of passenger ropeways and passenger conveyors within the scope of CSA Z98-14. It covers ropeways used for transport, snowfields and those used as amusement rides.

2 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS

1012	Methods of testing concrete (series)
1065	Non-destructive testing—Ultrasonic testing of carbon and low alloy steel forgings
1171	Non-destructive testing—Magnetic particle testing of ferromagnetic products, components and structures
1394	Round steel wire for ropes
1403	Design of rotating steel shafts
1657	Fixed platforms, walkways, stairways and ladders—Design, construction and installation
1710	Non-destructive testing—Ultrasonic testing of carbon and low alloy steel plate and universal sections—Test methods and quality classification
1796	Certification of welders and welding supervisors
1940	The storage and handling of flammable and combustible liquids
2062	Non-destructive testing—Penetrant testing of products and components
2076	Wire-rope grips for non-lifting applications
2084	Non-destructive testing—Eddy current testing of metal tubes
2177	Non-destructive testing—Radiography of welded butt joints in metal
2207	Non-destructive testing—Ultrasonic testing of fusion welded joints in carbon and low alloy steel
2214	Certification of welding supervisors—Structural steel welding
2321	Short-link chain for lifting purposes
2342	Development, testing and implementation of information and safety symbols and symbolic signs
2452	Non-destructive testing—Determination of thickness
2452.1	Part 1: Determination of wall thickness of pipe by the use of radiography
2452.3	Part 3: Use of ultrasonic testing

AS	
2671	Hydraulic fluid power—General requirements for systems (ISO 4413:1998, MOD)
2759	Steel wire rope—Use, operation and maintenance
2824	Non-destructive testing—Ultrasonic methods—Evaluation and quality classification of metal bearing bonds (ISO 4386-1:1992, MOD)
2841	Galvanized steel wire strand
3507	Non-destructive testing
3507.1	Part 1: Guide to radiography for ferrous castings
3507.2	Part 2: Radiographic determination of quality of ferrous castings
3569	Steel wire ropes—Product specification
3600	Concrete structures
3775	Chain slings for lifting purposes—Grade T(80) and V(100)
3775.1	Part 1: Product specification
3978	Non-destructive testing—Visual inspection of metal products and components
3990	Mechanical equipment—Steelwork
4024	Safety of machinery
4024.1301	Part 1301: Risk assessment—Principles of risk assessment
4024.1401	Part 1401: Ergonomic principles—Design principles—Terminology and general principles
4024.1501	Part 1501: Design of safety related parts of control systems—General principles for design
4024.1601	Part 1601: Design of controls, interlocks and guarding—Guards—General requirements for the design and construction of fixed and movable guards
4024.1604	Part 1604: Design of controls, interlocks and guarding—Emergency stop—Principles for design
4024.1904	Part 1904: Displays, controls, actuators and signals—Indication, marking and actuation—Requirements for visual, auditory and tactile signals
4100	Steel structures
4142	Fibre ropes
4142.1	Part 1: Care and safe usage
4291	Mechanical properties of fasteners made of carbon steel and alloy steel (series)
4544	Non-destructive testing—Eddy current testing for the detection of surface flaws—Ferromagnetic and non-ferromagnetic metallic products
60204	Safety of machinery—Electrical equipment of machines
60204.1	Part 1: General requirements (IEC 60204-1, Ed.5 (FDIS) MOD)
61508	Functional safety of electrical/electronic/programmable electronic safety-related systems (series)
AS/NZS	
1170	Structural design actions (series)
1269	Occupational noise management
1269.2	Part 2: Noise control management
1554	Structural steel welding (series)
1768	Lightning protection

AS/NZS

- 1891 Industrial fall-arrest systems and devices
- 1891.4 Part 4: Selection, use and maintenance
- 2574 Non-destructive testing—Ultrasonic testing of ferritic steel castings
- 2980 Qualification of arc-welders for fusion welding of steels
- 3000 Electrical installations (known as the Australian/New Zealand Wiring Rules)
- 3008 Electrical installations—Selection of cables
- 3008.1.1 Part 1.1: Cables for alternating voltages up to and including 0.6/1 kV—
Typical Australian installation conditions
- 4812 Non-destructive examination and discard criteria for wire ropes in mine winding systems

EN

- 1891 Personal protective equipment for prevention of falls from a height—Low stretch kernmantel ropes
- 12385 Steel wire ropes—Safety
- 12385-9 Part 9: Locked coil carrying ropes for cableway installations designed to carry persons

Australian Building Codes Board

NCC National Construction Code

CSA

Z98-14 Passenger ropeways and passenger conveyors

Commonwealth of Australia

Disability Standards for Accessible Public Transport 2002

3 DEFINITIONS

For the purposes of this Standard, the definitions below apply.

3.1 Competent person

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

3.2 Counterweight rope

A rope that is used to impart tension to a ropeway system, and which is usually static and does not form part of the main hauling rope for the ropeway system.

NOTE: CSA Z98-14 refers to a tension rope as a counterweight rope.

3.3 Loading conveyor

A device where passengers boarding a circulating ropeway are transported while standing on a flexible moving element in a manner that aids coupling with the carriers of the ropeway.

3.4 Passenger conveyor

A device where passengers are transported, while standing, for recreational purposes on a flexible moving element, excluding devices used as loading conveyors.

3.5 Passenger ropeway

A powered ropeway used for transporting, in a horizontal or inclined plane, passengers moved by carriers that are—

- (a) attached to or supported by a moving rope; or
- (b) attached to a moving rope but supported by a standing rope, or other overhead structure.

NOTES:

- 1 The term includes the prime mover and any transmission machinery, supporting structure and equipment. It does not include equipment such as cog railways, cablecars running on rails, equipment such as flying foxes, or elevating systems for vehicles or boat-style carriers associated with amusement rides such as log or boat flume rides.
- 2 This Standard uses the terms ‘rope’ and ‘ropeway’ in preference to the terms ‘cable’ and ‘cableway’.

4 CANADIAN REFERENCED DOCUMENTS

References in CSA Z98-14 shall be replaced by Australian Standards or other relevant equivalent documents some of which are indicated in Clause 5 for the particular Clause in which they are referenced unless another document is called up by legislation.

NOTE: Documents that are referenced in CSA Z98-14 but are not specifically mentioned in Clause 5 are applicable in Australia.

5 VARIATIONS TO CANADIAN REQUIREMENTS

Passenger ropeways and passenger conveyors shall conform to CSA Z98-14, varied in accordance with this Clause.

NOTES:

- 1 Additional information is provided on certain clauses to assist in the interpretation and implementation of the requirements in CSA Z98-14. Such information is indicated by the word ‘Commentary’ preceding the text.
- 2 Any clause reference in the following table is to CSA Z98-14 unless specified otherwise.

CSA Z98-14 clause reference	Australian variation
3	<i>Commentary:</i> The term ‘designer’ should be interpreted in context; for example, in Clause 4.2.1 the term may refer to the designer of the alteration rather than the original designer of the ropeway. When applying CSA Z98-14, it should be noted that the term ‘drive’ is used for the motor alone, whereas in Australia the term is usually used to refer to the prime mover (motor or engine) and associated drive train components such as the gearbox. ‘Drive’ may also be used to indicate the electric motor controller, such as a VFD, in Australia. The term ‘engineer’ is used in CSA Z98-14; the term ‘competent person’ should be substituted for Australian applications.
4.3.1	<i>Add</i> the following: (r) lightning risk.

CSA Z98-14 clause reference	Australian variation
	<i>Commentary:</i> In considering the list of aspects in Clause 4.3.1, the effect of each on operational aspects of the ropeway should be considered, such as— (a) exposure of passengers to adverse climatic conditions; (b) ground access for inspection, maintenance and evacuation; and (c) corrosive environments.
4.3.2	<i>Replace</i> Clause 4.3.2, including the heading, with the following: Overhead and underground systems Clearances between ropeways and overhead or underground electricity supply systems or communications systems shall be determined prior to construction, to ensure compliance with the requirements of the authority having control of the system. The following circumstances shall be taken into account: (a) Failure of a conductor or any part of an overhead system (such as overturning at the ground line). (b) Deropement resulting in the haul rope not being retained (by sheaves or catcher devices) on one or a number of towers for which the resulting sag (vertical deflection) would approach the overhead system under loading variations, acceleration and braking. (c) The loss of support or hold down of a haul rope from one or other of the two towers on either side of the overhead system. (d) The most adverse static loading conditions. (e) The most adverse dynamic conditions, including adverse loading, temperatures, rope stretch, tolerances, acceleration, and braking, taken as— (i) for track ropes, maximum static sag plus 10%; (ii) for haul ropes, maximum static sag plus 20%; and (iii) for haul rope throw over, maximum unsupported sag plus 30%.
4.4.1.1	<i>Add</i> the following after the first paragraph: In addition, AS/NZS 1170 (series), AS 4100, AS 3990, AS 1657, AS/NZS 1768, AS 4291 and AS/NZS 1891.4 shall be consulted, if relevant.
4.5.1	<i>Delete</i> the text of Clause 4.5.1 and <i>replace</i> with the following: The selection of materials, the manufacture of components and the quality of materials and components shall comply with the requirements of Australian Standards or national or international equivalents, provided such equivalent Standards are in use in their country of origin for the construction of passenger ropeways or conveyors. The quality and testing of materials for use in passenger ropeways and conveyors shall be in accordance with the relevant Standards.
4.5.2	<i>Delete</i> Clause 4.5.2.

CSA Z98-14 clause reference	Australian variation
4.7.4 (new)	Add new Clause 4.7.4: 4.7.4 Where enclosed spaces are not permanently sealed, the design of the structure shall facilitate inspection of internal surfaces.
4.8.1	Delete the text of Clause 4.8.1 and <i>replace</i> with the following: Welding shall be performed in accordance with the relevant Standard for the type of welding, such as AS/NZS 1554 (series), AS 1796, AS 2214 or AS/NZS 2980.
4.8.2	Delete the text of Clause 4.8.2 and <i>replace</i> with the following: Shop and field welding of critical components shall be carried out by qualified welders in accordance with the relevant Standards for the type of welding, such as AS/NZS 1554 (series), AS 1796, AS 2214 or AS/NZS 2980.
4.8.3	In Item (c), <i>replace</i> the words ‘qualified welding inspector’ with ‘competent person’.
4.9.1	1 <i>Replace</i> ‘the Standards specified in Clause 2’ with ‘relevant Australian Standards, such as AS/NZS 1170 (series), AS 4100, AS 3990, AS 1657 and AS 3600’, components that are classified under the NCC such as operator rooms and ropeway tower structures. Towers and attendant huts, shall be designed and constructed in accordance with requirements of the National Construction Code. 2 <i>Add</i> the following: Noise levels within and emanating from station enclosures and machine rooms shall be factored into the design in accordance with AS/NZS 1269.2.
4.11.1.1, Note	<i>Replace</i> ‘NFPA 30’ with ‘AS 1940’.
4.11.2	<i>Commentary:</i> A governor refers to both mechanical and electronic types of speed control. Certain types of electronic governors can be affected by radio transmission causing overspeed. Only electronic governors having a minimum degree of immunity to electromagnetic interference should be used such as those meeting the requirements of IEC 61000-6-2 <i>Electromagnetic compatibility (EMC) — Part 6-2: Generic standards – Immunity for industrial environments</i>.
4.11.3.2	Delete the text of Clause 4.11.3.2 and <i>replace</i> with the following: Portions of exhaust pipes within 2.5 m of the floor shall be guarded, equipped with heat shields or insulated.
4.12.1	<i>Commentary:</i> Hydraulic system components should be selected in accordance with AS 2671. The safety factor is the ratio of the bursting pressure to the maximum working pressure.

CSA Z98-14 clause reference	Australian variation
4.12.14 (new)	<i>Add new Clause 4.12.14:</i> 4.12.14 Redundant emergency brake valve An emergency brake when spring applied and hydraulic released shall have a redundant electrically operated valve with a separate line from the valve to tank. Provision shall be made to check the function of the redundant valve on a regular basis.
4.13.1.1, Note	<i>Replace with the following:</i> AS/NZS 1170 (series) and AS 3600 are suitable reference publications. <i>Commentary:</i> The AS/NZS 1170 series provides the basis for the design of structures in Australia.
4.13.1.6	<i>Add the following:</i> The anchorage, including structural steel components below ground shall be protected against corrosion and erosion and have a minimum specified design life as per Clause 4.6.2.3, unless a longer life is warranted. Continued reliance on the component beyond the design life shall be the subject of a testing and inspection plan prepared by a competent person. <i>Commentary:</i> If rock is not adequately prepared before the concrete is placed on it, water can get in under the concrete and corrode the rock anchors.
4.13.3.1	<i>Replace ‘CAN/CSA-A23.2’ with ‘AS 1012 (series)’.</i>
4.17.2.1	<i>Add the following:</i> Where ready access to line structures, towers and stations is available through the use of mobile cranes and elevating work platforms and these means of access are to be used, permanent means of access is not required. A suitable EWP or mobile crane shall be readily available on site whilst the ropeway is in operation. Where a permanent means of access is provided but does not comply with AS 1657, a fall-arrest system that prevents a fall greater than 600 mm shall be implemented during access operations. <i>Commentary:</i> Regulations covering working at height may apply to certain activities associated with ropeway maintenance.
4.17.5.3	<i>Replace with the following:</i> Work platforms shall comply with AS 1657 with the following exceptions: (a) The height of kickboards shall be determined by the designer on the basis of a risk assessment. NOTE: The kickboards of tower and other work platforms for snowfield ropeways may be reduced from the height specified by AS 1657 so as to limit loads imposed by accumulation of snow and ice.