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SINGAPORE STANDARD

Specification for design of active fall-protection systems

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This Singapore Standard was approved by the General Engineering and Safety Standards Committee on behalf of the Singapore Standards Council on 1 October 2015.

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

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

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

AECOM Singapore Pte Ltd
Association of Consulting Engineers Singapore
Association of Singapore Marine Industries
Engineers 9000 Pte Ltd
Housing and Development Board
Institution of Engineers, Singapore
Keon Consult Pte Ltd
Land Transport Authority
Ministry of Manpower
National University of Singapore
PDS International Pte Ltd
Singapore Institution of Safety Officers
TRACTEL Singapore Pte Ltd
Workplace Safety and Health Council

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National Foreword

This Singapore Standard was prepared by the Working Group appointed by the Technical Committee on Personal Safety and Health under the direction of the General Engineering and Safety Standards Committee.

This Singapore Standard is a modified adoption of CSA Z259.16-04(R2014) – 'Design of active fall-protection systems', published by the Canadian Standards Association.

The modifications are given in Annex ZA which contains the technical deviations and their explanations to suit the local requirements and the needs of the industry. The changes in the main text are indicated with lines along the margins.

In preparing this standard, reference was also made to the following publications:

1.	ANSI/ASSE Z359.6	Specifications and design requirements for active fall protection systems
2.	SS 528	Specification for personal fall-arrest systems. Part 1: Full body harnesses Part 2: Lanyards and energy absorbers Part 3: Self-retracting lifelines Part 4: Vertical rails and vertical lifelines incorporating a sliding-type fall arrester Part 5: Connectors with self-closing and self-locking gates Part 6: System performance tests
3.	SS 541	Specification for restraint belts
4.	SS 570	Specification for personal protective equipment for protection against falls from a height. Single point anchor devices and flexible horizontal lifeline systems
5.	Workplace Safety and Health (Work at Heights) Regulations	

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.*

Preface

This is the first edition of CSA Z259.16, Design of active fall-protection systems. It is part of the Z259 series of Standards for components of personal fall-arrest systems.

The purpose of this standard is to specify requirements for the design and performance of complete active fall-protection systems, including travel-restraint and vertical and horizontal fall-arrest systems.

This Standard was prepared by the Technical Committee on Fall Protection, under the jurisdiction of the Strategic Steering Committee on Occupational Health and Safety, and has been formally approved by the Technical Committee. It will be submitted to the Standards Council of Canada for approval as a National Standard for Canada.

February 2004

NOTES:

(1) Use of the singular does not exclude the plural (and vice versa) when the sense allows.

(2) Although the intended primary application of this Standard is stated in its Scope, it important to note that it remains the responsibility of the users of the Standard to judge its suitability for their particular purpose.

(3) This publication was developed by consensus, which is defined by CSA Policy governing standardization – Code of good practice for standardization as "substantial agreement. Consensus implies much more than a simple majority, but not necessary unanimity". It is consistent with this definition that a member may be included in the Technical Committee list and yet not be in full agreement with all clauses of this publication.

(4) CSA Standards are subject to periodic review, and suggestions for their improvement will be referred to the appropriate committee.

(5) All enquiries regarding this Standard, including requests for interpretation, should be addressed to Canadian Standards Association, 5060 Spectrum Way, Suite 100, Mississauga, Ontario, Canada L4W 5N6.

Requests for interpretation should

(a) define the problem, making reference to the specific clause, and, where appropriate, include an illustrative sketch;

(b) provide an explanation of circumstances surrounding the actual field condition; and

(c) be phrased where possible to permit a specific "yes" or "no" answer.

Committee interpretations are processed in accordance with the CSA Directives and guidelines governing standardization and are published in CSA's periodical Info Update, which is available on the CSA Web site at www.csa.ca.

Specification for design of active fall-protection systems

1 Scope

1.1 This Standard is intended for professional engineers with expertise in designing fall-protection systems. It specifies requirements for the design and performance of complete active fall-protection systems, including travel-restraint and vertical and horizontal fall-arrest systems.

1.2 This Standard is not intended as a substitute for testing and certification of individual components of fall-protection equipment in accordance with applicable CSA Z259 equipment Standards.

1.3 This Standard does not cover the design of passive fall-protection systems such as guardrails and nets, except where such passive systems are also designed to serve as anchorage and/or anchorage connector subsystems for active fall-protection systems covered by this Standard.

1.4 This Standard does not cover the design of positioning systems.

1.5 This Standard does not cover the determination of structural strength and behaviour of components or anchorages of active fall-protection systems. It does, however, establish the safety criteria once the strengths and behaviours are known. Such strengths and behaviours are determined by analytical testing or engineering methods and by CSA or other design Standards for the materials and structural systems being used.

1.6 This Standard does not specify design or performance requirements for fall-arrest equipment or systems that have been manufactured and successfully tested in accordance with the requirements of another CSA Z259 Standard.

1.7 This Standard does not supersede the requirements of applicable occupational safety and health regulations. Where the requirements in this Standard differ from legislated requirements, the most conservative requirement is followed.

1.8 In CSA Standards, “shall” is used to express a requirement, i.e., a provision that the user is obliged to satisfy in order to comply with the standard; “should” is used to express a recommendation or that which is advised but not required; and “may” is used to express an option or that which is permissible within the limits of the standard. Notes accompanying clauses do not include requirements or alternative requirements; the purpose of a note accompanying a clause is to separate from the text explanatory or informative material. Notes to tables and figures are considered part of the table or figure and may be written as requirements. Legends to equations and figures are considered requirements.

2 Reference publications

This Standard refers to the following publications, and where such reference is made, it shall be to the edition listed below, including all amendments published thereto.

CSA (Canadian Standards Association)

A23.3-94 (R2000)	*Design of Concrete Structures*
CAN/CSA-C225-00	*Vehicle-Mounted Aerial Devices*
G4-00	*Steel Wire Rope for General Purpose and for Mine Hoisting and Mine Haulage*

G40.20-04/G40.21-04	*General requirements for rolled or welded structural quality steel/Structural quality steel*
PLUS 1156	*Fall-Arrest Systems – Practical Essentials,* by Andrew C. Sulowski
CAN/CSA-S16-01	*Limit States Design of Steel Structures*
CAN/CSA-Z91-02	*Health and Safety Code for Suspended Equipment Operations*
Z259 series of Standards:	
CAN/CSA-Z259.1-95 (R1999)	*Safety Belts and Lanyards*
CAN/CSA-Z259.2.1-98 (R2004)	*Fall Arresters, Vertical Lifelines, and Rails*
CAN/CSA-Z259.2.2-98 (R2004)	*Self-Retracting Devices for Personal Fall-Arrest Systems*
Z259.2.3-99	*Descent Control Devices*
CAN/CSA-Z259.10-M90 (R2003)	*Full Body Harnesses*
CAN/CSA-Z259.11-M92 (R2003)	*Shock Absorbers for Personal Fall Arrest Systems*
CAN/CSA-Z259.12-01	*Connecting Components for Personal Fall Arrest Systems (PFAS)*
Z259.13-04	*Flexible horizontal lifeline systems*
Z259.15 (under development)	*Anchorage connectors*
CAN/CSA-Z271-98 (R2003)	*Safety Code for Suspended Elevating Platforms*

ANSI (American National Standards Institute)

Z359.1-1992 (R1999)	*Safety Requirements for Personal Fall Arrest Systems, Subsystems and Components*

National Research Council Canada

National Building Code of Canada, 1995

Other publications

Arteau, J. (2003). “Protection contre les chutes de hauteur : absorbeur d’energie, distance de freinage, grande hauteur de chute et grande masse (Protection against falls from height: energy absorber, deceleration distance, large free fall distance and large mass)”. Actes du 25^{e} congrès de l’AQHSST, Trois-Rivières, 7-9 May, 2003, pp. 249-260

Sulowski, A. C. *Evaluation of Fall Arresting Systems* (Ontario Hydo Research Report 78-98-H). Toronto, 1978