

ANSI/ASSP Z359.4-2013

Safety Requirements for Assisted-Rescue and Self-Rescue Systems, Subsystems and Components

Part of the Fall Protection Code

The American Society of Safety Engineers (ASSE) is now the American Society of Safety Professionals (ASSP). ASSP continues to be the Secretariat for the committee producing this standard and continues to hold the copyright to this standard. There is no change to the content and requirements in the standard. The only change is on the cover indicating the organizational name change of the standards developing organization from ASSE to ASSP.



**AMERICAN SOCIETY OF
SAFETY PROFESSIONALS**

Copyright American Society of Safety Professionals
Provided by IHS Markit under license with ASSE/SAFE
No reproduction or networking permitted without license from IHS
Full document details: ASSP Z359.4 2013

Licensee=, User=,
Not for Resale,



The information and materials contained in this publication have been developed from sources believed to be reliable. However, the American Society of Safety Engineers (ASSE) as secretariat of the ANSI accredited Z359 Committee or individual committee members accept no legal responsibility for the correctness or completeness of this material or its application to specific factual situations. By publication of this standard, ASSE or the Z359 Committee does not ensure that adherence to these recommendations will protect the safety or health of any persons, or preserve property

American National Standard

**Safety Requirements for
Assisted-Rescue and Self-Rescue Systems,
Subsystems and Components**

ANSI/ASSE Z359.4-2013

Secretariat

American Society of Safety Engineers
1800 East Oakton Street
Des Plaines, Illinois 60018-2187

Approved March 8, 2013

American National Standards Institute, Inc.

American National Standard

Approval of an American National Standard requires verification by ANSI that the requirements for due process, consensus, and other criteria for approval have been met by the standards developer. Consensus is established when, in the judgment of the ANSI Board of Standards Review, substantial agreement has been reached by directly and materially affected interests. Substantial agreement means much more than a simple majority, but not necessarily unanimity. Consensus requires that all views and objections be considered, and that a concerted effort be made toward their resolution. The use of American National Standards is completely voluntary; their existence does not in any respect preclude anyone, whether he/she has approved the standards or not, from manufacturing, marketing, purchasing, or using products, processes, or procedures not conforming to the standards. The American National Standards Institute does not develop standards and will in no circumstance give an interpretation of any American National Standard. Moreover, no person shall have the right or authority to issue an interpretation of an American National Standard in the name of the American National Standards Institute. Requests for interpretation should be addressed to the secretariat or sponsor whose name appears on the title page of this standard.

Caution Notice: This American National Standard may be revised or withdrawn at any time. The procedures of the American National Standards Institute require that action be taken periodically to reaffirm, revise, or withdraw this standard. Purchasers of American National Standards may receive current information on all standards by calling or writing the American National Standards Institute.

Published June, 2013 by

American Society of Safety Engineers
1800 East Oakton Street
Des Plaines, Illinois 60018-2187
(847) 699-2929 • www.asse.org

Copyright ©2013 by American Society of Safety Engineers
All Rights Reserved.

No part of this publication may be reproduced in any form, in an electronic retrieval system or otherwise, without the prior written permission of the publisher.

Printed in the United States of America

Foreword (This Foreword is not a part of American National Standard Z359.4-2013.)

Individuals engaged in rescue operations in areas where exposure to a fall hazard exists will benefit from the information contained in this standard. This standard addresses equipment and performance criteria for systems, subsystems and components used in preplanned assisted-rescue and self-rescue where a fall hazard exists. Requirements for adequate training and thorough pre-planning efforts prior to the initiation of assisted-rescue or self-rescue operations address the needs of both the rescuer and the rescue subject. This standard establishes criteria for equipment marking, testing, care and use.

This standard is part of a series of American National Standards for Fall Protection for all occupational and non-occupational activities. It is not intended to apply to sports activities such as mountaineering, nor to specialized rescue efforts that may be associated with such activities. The first ANSI standard of this series, Z359.1 published in 1992 and was revised in 2007, addresses personal fall arrest systems. Other standards planned for the Z359 series will address related subjects, and the overall fall protection program.

Whenever fall arrest systems are used, indeed, whenever a fall hazard exists, it is necessary to plan for the effective rescue of persons who have experienced a fall event, whether it be a self-rescue application or assisted rescue application. Considering the diverse technical and environmental circumstances that can be presented to rescue personnel, development of a comprehensive rescue plan is integral to the safety of rescue personnel, the rescue subject, and the eventual success of the rescue effort.

The comprehensive rescue plan predicts circumstances that might require rescue activities, anticipates hazards associated with rescue operations, identifies methods to control those hazards, recommends the appropriate response measures and identifies the fall arrest and retrieval equipment to be used. The rescue plan may call for methods or equipment that are outside the scope of this standard, such as technical rope rescue, when such methods are reasonable and feasible and estimated to be the most effective rescue method.

The Z359 Committee solicits public input that may suggest the need for revisions to this standard. Such input should be sent to the Secretariat, ASC Z359, American Society of Safety Engineers, 1800 E. Oakton Street, Des Plaines, IL 60018-2187.

This standard was developed and approved for submittal to ANSI by the American National Standard Committee on Standards for Fall Protection, Z359. Committee approval of the standard does not necessarily imply that all Committee members voted for its approval. At the time it approved this standard, the Z359 Committee had the following members:

Randall Wingfield, Chairman
 Basil Tominna, P.E., Vice Chairman
 Timothy R. Fisher, CSP, CHMM, ARM, CPEA, Secretary
 Jennie Dalesandro, Administrative Technical Support

Organization Represented	Name of Representative
3M	Raymond Mann
American Airlines	Michael Cameron
American Society of Safety Engineers	Dean Carlisle
Bashlin Industries, Inc.	Len Bradley
Boeing Company	Jubal D. Hamernik, Ph.D., P.E.
Buckingham Mfg. Co., Inc.	John Stephen Frost, CSP
Capital Safety Group	Preston Anderson
Chevron	Bradley S. McGill
Elk River, Inc	Chuck Orebaugh
Ellis Fall Safety Solutions, LLC	Joey R. Junio
Flexible Lifeline Systems	James Rullo
General Motors	DeForest Canfield
Gravitec Systems, Inc.	J. Thomas Wolner, P.E.
Hartford Steam Boiler Inspection & Insurance Co.	Judd Perner
High Engineering Corp.	Craig Berkenmeier
Honeywell Safety Products	Stephanie Alvarez
ISEA – International Safety Equipment Association	Kevin Whaley
Indianapolis Power and Light	J. Nigel Ellis, Ph.D., P.E., CSP, CPE
INSPEC International Ltd.	John T. Whitty, P.E.
LJB Inc.	Hugh Armstrong
Latchways PLC	David Lee
Lawrence Livermore National Security	Ken Mahnick
Liberty Mutual Group	Kyle Sullivan
	Randall Wingfield
	Dave Lough
	Timothy Healey
	Jerome Kucharski, CFPS
	Greg Small, P.Eng., M.Eng.
	Doug Myette
	Bradley Rohlf
	Dustin Hawkins
	Dan Shipp
	David H. Pate, CUSA
	Paul Clarke
	Andrew Diamond
	Thomas Kramer, P.E., CSP
	Rupert Noton, CEng, MStructE
	Tim Bissett, BEng (Hons) CEng, MIMechE
	Tim Fletcher
	Lynn Camp
	John Rabovsky, MS, CSP, ARM
	Cal Sparks

Lighthouse Safety LLC
MSA

Monsanto

Murdock Webbing Co. Inc.

National Association of Tower Erectors

Pamela R. Huck, Inc.
Peakworks

PenSafe
Reliance Industries, LLC

SPRAT – Society of Professional Rope
Access Technicians

Safety Connection, Inc.

Safety Equipment Institute
Safety Through Engineering, Inc.

Sellstrom Manufacturing Co./RTC Division

Shell Exploration & Production Co.

Skylotec N.A., LP

SPANCO, Inc. / Rigid Lifelines

Sturges Manufacturing Co., Inc.

Superior Energy Services, Inc.

Tractel Inc.

Transport Workers Union
Travelers
Tritech Fall Protection Systems, Inc.

United Auto Workers

U.S. Air Force Safety Center

U.S. Bureau of Reclamation

U.S. Department of Interior – BSEE

John Corriveau
Marc Harkins
John Giovengo
Robert Kling, P.E., CSP
Adam Chapin
Bob Golz
Greg Pilgrim
Gordon Lyman
Don Doty
Pamela Huck, CSP
Tim Accursi
Gabe Fusco
Keith Smith
Dan Henn
W. Joe Shaw

Loui McCurley
Jim Frank
Clint Honeycutt, Sr.
Janice Honeycutt
Steve Sanders
Michael C. Wright, P.E., CPE, CSP
Mark Williams
Kenneth Lemke
Tim Higgins
Steven Kim Biggs
Joe B. George
Mark Conover
Kurani Seyhan
Arnie Galpin, P.E.
George Nolan
Richard Griffith
Tyler Griffith
Noel Spicuzza, III
David Turner
Doug Knapp
Catalin Anesia
James Mark
Scott H. Richert, CSP, ARM, ALCM
John Seto, P.E.
Craig Siciliani
Tom Kinman
Matthew S. Uptmor
Mark S. Kantorowicz
Robert Baker
Shawn Smith
Shaun Reed
John M. Cushing, Jr.
Sara Corman

U.S. Department of the Navy

Vertical Access LLC

Western Area Power Administration

Basil Tominna, P.E.

Shawn Smith

Kelly Streeter, P.E.

Keith Luscinski

Subgroup Z359.4 had the following members:

J. Thomas Wolner, P.E. (Chair)

Jeff Wild (Vice Chair)

Steven Kim Biggs

Paul Clarke

Mark Conover

John Corriveau

J. Nigel Ellis, Ph.D., P.E., CSP, CPE

Jim Frank

Paul Illick

Thomas Kramer, P.E., CSP

Jack Lamberson

Loui McCurley

David H. Pate, CUSA

Diane Waghorne

Randall Wingfield

Michael C. Wright, P.E., CPE, CSP



Documents

Document Sharing Hub

Contents

SECTION PAGE

1. Scope, Purpose, Application, Exceptions and Interpretations	8
1.1 Scope	8
1.2 Purpose and Application	8
1.3 Exceptions	8
1.4 Interpretations	9
2. Definitions	9
3. Requirements	9
3.1 System Requirements	9
3.2 Component and Element Requirements	9
3.3 Corrosion Protection	17
4. Qualification Testing	17
4.1 Test Equipment and Test Specimens	17
4.2 Reserved for Future Use	18
4.3 Component, Constituent and Element Testing	18
5. Marking and Instructions	27
5.1 General Marking Requirements	27
5.2 Specific Marking Requirements	28
5.3 General Instruction Requirements	29
5.4 Specific Instruction Requirements	31
6. Inspection, Maintenance and Storage of Equipment	33
6.1 Inspection	33
6.2 Maintenance and Storage	35
7. Equipment Selection, Rigging, Use and Training	35
7.1 Equipment Selection	35
7.2 Equipment Rigging and Use	37
7.3 Training	38
8. References	40

Figures:

Figure 1 Static Strength Testing of Synthetic Rope Tackle (Section 4.3.4.1)	42
Figure 2a Descent Test (Section 4.3.5.1)	43
Figure 2b Descent Test (Section 4.3.5.1)	44
Figure 3 Descent Device Static Strength Testing (Figures a, b & c) (Section 4.3.5.2)	45
Figure 4a Descent Device Dynamic Strength Test (Section 4.3.5.3)	46
Figure 4b Descent Device Dynamic Strength Test (Section 4.3.5.3)	47

STANDARD REQUIREMENTS**1. SCOPE, PURPOSE, APPLICATION, EXCEPTIONS AND INTERPRETATIONS**

1.1 Scope. This standard establishes requirements for the performance, design, marking, qualification, instruction, training, use, maintenance and removal from service of connectors, harnesses, lanyards, anchorage connectors, winches/hoists, descent control devices, rope tackle blocks and self-retracting lanyards with integral rescue capability comprising rescue systems, utilized in pre-planned self-rescue and assisted-rescue applications for one to two persons.

1.2 Purpose and Application. The purpose of this standard is to establish criteria to ensure suitability of the equipment and methods defined herein for use in rescue situations where a fall hazard exists.

Rescue system elements, components or subsystems meeting the requirements of this standard may not be represented as complying with or used in personal fall arrest systems (PFAS) claiming compliance with ANSI/ASSE Z359.1 or other relevant Z359 standards unless the requirements of that standard are additionally met. The requirements of this standard supersede any corresponding requirements in ANSI/ASSE Z359.1 American National Standards

1.3 Exceptions.

1.3.1 The requirements of this standard do not address sport-related activities, rope access rescue techniques utilized by certified rescue technicians or other tasks that have established national consensus standards. However, this does not preclude use of equipment addressed within this standard for such activities where appropriate.

1.3.2 The competent person shall determine the suitability of equipment addressed within this standard for activities conducted in hazardous atmospheres.

EXPLANATORY INFORMATION

(Not part of American National Standard Z359.4)

E1.3.2 *For a definition of competent person refer to the ANSI/ASSE Z359.0, Definitions and Nomenclature Used for Fall Protection and Fall Arrest, and for additional information refer to ANSI/ASSE Z359.2, Minimum Requirements for a Comprehensive Managed Fall Protection Program.*

1.4 Interpretations. Requests for interpretations of this standard shall be in writing and addressed to the Secretariat of this standard.

2. DEFINITIONS

Please refer to ANSI/ASSE Z359.0, *Definitions and Nomenclature Used for Fall Protection and Fall Arrest*, for definitions of terms used in this standard.

3. REQUIREMENTS

3.1 System Requirements.

3.1.1 A rescue system shall be used only if attached to an anchorage, or anchorage with anchorage connector, which complies with the requirements of this standard.

3.1.2 The capacity of a one-person rescue system shall range from 130 to 310 pounds (59 to 141kg). The capacity of a two-person rescue system shall range from 130 to 620 pounds (59 to 282kg). The maximum and minimum rated working loads for each system component shall encompass the capacity range of the assembled system.

3.2 Component and Element Requirements.

3.2.1 Connector (Hardware) Components and Elements. Connectors used in rescue systems shall meet requirements of ANSI/ASSE Z359.12. Connectors complying with these requirements are suitable for use in one and two person rescue systems.

3.2.2 Body Support Components.

***E3.1.2** Some components such as hoists or rope tackle blocks may have working load ratings that differ from the capacity range. This may be for purposes such as material handling. The requirements of this standard only address rescue applications of these components.*

***E3.2** The component and element requirements contained within this section are minimum design and performance requirements and are not intended to control the design or manufacturing process. It is the responsibility of the manufacturer to ensure appropriate controls and procedures are applied to ensure consistent quality. Basic engineering principals including but not limited to material selection and compatibility, factors of safety, environmental considerations and process viability should be applied.*

3.2.2.1 Full Body Harness.

3.2.2.1.1 Full body harnesses shall meet the requirements of ANSI/ASSE Z359.1. Unless specifically prohibited for rescue use by the manufacturer, the dorsal attachment element is suitable for rescue application and need not be evaluated in accordance with 3.2.2.1.2 or 3.2.2.1.3.

3.2.2.1.2 Static Strength. When statically tested 3,600 pounds (16kN) in accordance with 4.3.1.1, harness attachment elements designated by the manufacturer as suitable for rescue purposes shall not release the test torso and no load-bearing element shall break or separate from the harness.

3.2.2.1.3 Dynamic Performance. When dynamically tested in accordance with 4.3.1.2, harness attachment elements designated by the manufacturer as suitable for rescue purposes shall not release the test torso and no load-bearing element shall break or separate from the harness. The test torso shall remain suspended for one minute after the test. The angle at rest between the torso vertical centerline and the vertical shall not exceed 30 degrees after the torso comes to a rest.

3.2.2.2 Evacuation Harness.

3.2.2.2.1 The evacuation harness shall at minimum provide support for the body around the shoulders and thighs.

3.2.2.2.2 Load-Bearing Straps. Load-bearing straps or other harness textile materials that serve an equivalent function shall be made from virgin synthetic materials having strength, aging, abrasion resistance and heat resistance characteristics equivalent or superior to polyamides. Body supporting evacuation harness straps shall not be less than 1-5/8 inches (41mm).

3.2.2.2.3 Thread and Stitching. Lock stitching shall be used at all sewn joints. The thread shall be of the same type as the load-bearing member and shall be of a contrasting color to facilitate inspection.

***E3.2.2.1** Full body harness as defined in ANSI/ASSE Z359.0 and for additional information see ANSI/ASSE Z359.1.*

***E3.2.2.1.1** In some situations, the manufacturer may prohibit use of the dorsal attachment element for rescue. For example, if the dorsal attachment element is occupied by another subsystem, connection of a second connector (to the same point) for rescue purposes may not be possible or recommended.*

***E3.2.2.2.1** The evacuation harness should properly fit and be designed to securely hold the rescue subject during rescue whether conscious or unconscious.*

3.2.2.2.4 Metal Elements. Metal elements shall be capable of withstanding a minimum salt spray test of 48 hours when tested in accordance with reference 8.2.1. The presence of red rust visible to the unaided eye or other evidence of corrosion of the base metal shall constitute failure of the salt spray test. Post-test presence of white scale on element surfaces is permitted. Surfaces, which come into contact with materials that may cut or tear, shall be free of burrs, pits, sharp edges or rough surfaces.

3.2.2.2.5 Static Strength. Evacuation harnesses when statically tested to 3,600 pounds (16kN) in accordance with 4.3.1.1 shall not release the test torso. No load-bearing element shall break or separate from the rescue harness.

3.2.2.2.6 Dynamic Performance. Evacuation harnesses when dynamically tested in accordance with 4.3.1.2, shall not release the test torso. The test torso shall remain suspended for one minute after drop testing. No load-bearing element shall break or separate from the self-rescue harness. The angle at rest between the torso vertical centerline and the vertical shall not exceed 30 degrees after the torso comes to a rest.

3.2.3 Rescue Lanyard Component.

3.2.3.1 Rescue lanyards shall meet the lanyard requirements of ANSI/ASSE Z359.1. Note: When statically tested, the load path for Y-rescue lanyards shall be as intended in service.

3.2.3.2 Connectors used in the construction of rescue lanyards shall meet the requirements of ANSI/ASSE Z359.12.

3.2.4 Rescue Anchorage Connector Component.

3.2.4.1 Rescue anchorage connectors shall meet the requirements for anchorage connectors specified in ANSI/ASSE Z359.1 and additional requirements of this standard.

3.2.5 Self-Retracting Lanyard Component with Integral Rescue Capability. Self-Retracting Lanyard with integral rescue capability (SRL-R) used in

E3.2.5 SRL-Rs complying with these requirements are suitable for use in one person rescue systems.

rescue systems shall meet requirements of ANSI/ASSE Z359.14.

3.2.6 Synthetic Rope Tackle Block.

3.2.6.1 Rope. Materials for virgin synthetic ropes used in rope tackle blocks shall have strength, aging, abrasion resistance and heat resistance characteristics equivalent to or superior to polyamides. When tested in accordance with reference 8.9.2, new rope shall have a minimum breaking strength of not less than 4,500 pounds (20kN).

3.2.6.2 Rope tackle blocks shall have a secondary means to prevent uncontrolled lowering of the load. Rope tackle blocks shall have a minimum theoretical mechanical advantage of 3:1.

3.2.6.3 Static Strength. When tested in accordance with 4.3.4.1, the rope tackle block shall withstand the applied load of 3,100 pounds (13.8kN) for at least one minute without failure of the device or any element part thereof. The static strength test shall be conducted for each rope type allowed for use with the device and each rigging configuration (e.g. 3:1, 4:1, 5:1 ratios).

3.2.6.4 Dynamic Strength. When tested in accordance with 4.3.4.2, the rope tackle block shall arrest the test weight. Following the dynamic strength test, the rope tackle block shall raise, lower and hold the load as intended after the device has arrested the test weight. The dynamic strength test shall be conducted for each rope type allowed for use with the device and each rigging configuration (e.g. 3:1, 4:1, 5:1 ratios).

3.2.6.5 Function. When tested in accordance with 4.3.4.3, the rope tackle block shall raise, lower and hold the load as intended while the device is carrying 125% of the maximum capacity. When operating control is released, the means for preventing uncontrolled lowering of the load shall halt the test weight within 12 inches (305mm). This test is to be repeated with a load of 75% of the minimum capacity. The functional tests shall be conducted for each rope type allowed for use with the device and each rigging configuration (e.g. 3:1, 4:1, 5:1 ratios).

***E3.2.6.2** The primary method is actions of the operator. The secondary method, independent of operator's actions, is a passive mechanical method for preventing uncontrolled descent.*

3.2.7 Descent Devices.

3.2.7.1 Descent Energy and Capacity. The capacity of descent devices addressed by this standard shall be 310 pounds (141kg), see 3.1.2, capacity one person. Descent devices designed for single use (one time use) shall have a minimum descent energy rating of 30,000 foot-pounds (40,675 joules). These devices shall be classified as: Single Use. Descent devices designed for repeated or multiple uses shall have a descent energy rating of not less than 300,000 foot-pounds (406,750 joules). The descent energy rating is determined by $E = W \times H \times N$; where E = Descent Energy Rating (foot-pounds); W = Test Weight (310 pounds (141kg)); H = Descent Height (feet); N = Number of Descents. When tested in accordance with 4.3.5.1, the descent device shall be capable of single or successive operation as applicable until the descent energy rating is reached. No component, constituent or element shall show signs of breaking or failure following descent energy testing. If the descent device is capable of being rigged in more than one way, the requirements of this section must be met for each rigging configuration.

3.2.7.2 Descent Speed. When tested in accordance with 4.3.5.1, the descent speed for automatic descent control devices shall be not greater than 6.6 feet/second (2m/s) or less than 1.6 feet/second (.49m/s). For manually operated descent control devices when tested in accordance with 4.3.5.1, the descent speed shall not exceed 6.6 feet/second (2m/s).

3.2.7.3 Static Strength. When tested in accordance 4.3.5.2, the descent device including the descent line as normally installed and terminated, shall be capable of sustaining a static load of 2,700 pounds (12kN) for at least one minute without release of the load.

3.2.7.4 Dynamic Strength. When tested in accordance with 4.3.5.3, the descent device, if designed to stop the weight if control is lost, shall stop and not release the test weight. The descent device including the descent line shall remain fully functional. When tested in accordance with 4.3.5.3, the descent device, if designed to continue lowering the load at a controlled rate if control is lost, shall remain functional and the descent speed shall not exceed 6.6 feet/second (2m/s).

3.2.7.5 Function. When tested in accordance with 4.3.5.4, the descent device shall function as intended and the descent speed shall meet the requirements of 3.2.7.2. In the case of manually operated devices, the descent device shall stop and hold the load if the control device is released (hands free) or if excessive application of the control device is applied (panic grasp). When tested in accordance with 4.3.5.4 in the two stop modes (hands free, panic grasp), the amount of line movement through the descent device or movement of the descent device on the line as applicable shall not exceed 6 inches (152mm). This test series shall be repeated following the wet conditioning defined in 4.3.5.4.

3.2.7.6 Design.

3.2.7.6.1 Line Material.

E3.2.7.6.1 The line material strength values specified in this section are not appropriate for use with descent devices for work positioning applications or other applications requiring a person to be suspended on line for purposes other than preplanned rescue.

3.2.7.6.1.1 Synthetic Rope. Rope used as a line constituent of a descent device shall be made of virgin synthetic materials having strength, aging, abrasion resistance and heat resistance characteristics equivalent or superior to polyamides. When statically tested in accordance with reference 8.9.2, synthetic rope shall have a minimum breaking strength of 3,000 pounds (13.3kN).

3.2.7.6.1.2 Webbing. Webbing used as a line constituent of a descent device shall be made of virgin synthetic materials having strength, aging and abrasion resistance and heat resistance characteristics equivalent or superior to polyamides. Webbing shall have a minimum breaking strength of 3,000 pounds (13.3kN) when tested in accordance with reference 8.9.1.

3.2.7.6.1.3 Wire Rope. Wire rope used as a line constituent of a descent device shall be constructed of stainless steel or galvanized steel strand having a minimum breaking strength of 3,000 pounds (13.3kN) when tested in accordance with reference 8.2.2.