NFPA®

2500

Standard for Operations and Training for Technical Search and Rescue Incidents and Life Safety Rope and Equipment for Emergency Services

2022

Includes
NFPA 1670 | NFPA 1858 | NFPA 1983

NFPA®

NFPA® 2500

Standard for Operations and Training for Technical Search and Rescue Incidents and Life Safety Rope and Equipment for Emergency Services

2022 Edition

NFPA, 1 Batterymarch Park, Quincy, MA 02169-7471
An International Codes and Standards Organization

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NFPA® 2500

Standard for

Operations and Training for Technical Search and Rescue Incidents and Life Safety Rope and Equipment for Emergency Services

2022 Edition

This edition of NFPA 2500, *Standard for Operations and Training for Technical Search and Rescue Incidents and Life Safety Rope and Equipment for Emergency Services*, was prepared by the Technical Committees on Special Operations Protective Clothing and Equipment and Technical Search and Rescue, released by the Correlating Committee on Fire and Emergency Services Protective Clothing and Equipment, and acted on by the NFPA membership during the 2021 NFPA Technical Meeting held June 14–July 2. It was issued by the Standards Council on August 26, 2021, with an effective date of September 15, 2021.

This document has been amended by one or more Tentative Interim Amendments (TIAs) and/or Errata. See "Codes & Standards" at www.nfpa.org for more information.

This edition of NFPA 2500 was approved as an American National Standard on September 15, 2021.

Origin and Development of NFPA 1250

For this first edition of NFPA 2500, *Standard for Operations and Training for Technical Search and Rescue Incidents and Life Safety Rope and Equipment for Emergency Services*, both NFPA 1858 and NFPA 1983 were part of a document consolidation plan that was approved during the April 2019 Standards Council meeting that affects all documents in the Emergency Response and Responder Safety (ERRS) project. NFPA 1858 and NFPA 1983 are included, along with NFPA 1670, in the newly formed NFPA 2500. The Technical Committee on Special Operations Protective Clothing and Equipment (FAE-SCE) remained responsible for the revision of NFPA 1858 and NFPA 1983.

There were no changes to the organization of the FAE-SCE. For the 2022 edition, revisions were made to add cleaning procedures to the user information in Chapter 25. The melting requirements were revised for fire escape rope, fire escape webbing, fire escape harnesses, and fire escape belts in Chapter 27. Chapter 27 was also revised to require escape anchors when supplied in an escape and fire escape system, that would meet the minimum performance requirements and be tested individually. Additionally, Chapter 27 has clarifications regarding how slippage should be measured during static testing of belts, life safety harnesses, and victim extrication devices.

The 2022 edition accounts for the first revision of NFPA 1858, the selection, care, and maintenance document that accompanies NFPA 1983. Several revisions were made throughout this document, with the relocation of certain annex material from NFPA 1983 to NFPA 1858. Chapter 32 has revisions and additional cleaning procedures.

The 2022 edition of NFPA 2500 also accounts for revisions to the material that had been included in NFPA 1670. Many of the changes to the material in Chapters 4 through 23 were made for alignment in the consolidated document. The Technical Search and Rescue committee also made changes to the material in Chapter 4 through 23 to bring those requirements into alignment with the newly published NFPA 1006.

For more information about the ERRS consolidation project see nfpa.org/errs.

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Rick L. Swan, *Chair*
IAFF Local 2881/CDF Fire Fighters, VA [L]
Rep. International Association of Fire Fighters

Jason L. Allen, Intertek Testing Services, NY [RT]

James B. Area, Chimera Enterprises International, MD [SE]

Joseph Arrington, San Antonio Fire Department, TX [U]

Roger L. Barker, North Carolina State University, NC [SE]

Cristine Z. Fargo, International Safety Equipment Association, VA [M]

Edmund Farley, Pittsburgh Bureau Of Fire, PA [E]

Diane B. Hess, PBI Performance Products, Inc., NC [M]

Thomas M. Hosea, US Department of the Navy, FL [RT]

Ronald Johnston, Superior Products, OH [M]
Rep. Compressed Gas Association

Beth C. Lancaster, US Department of Defense, VA [E]

Jeff Legendre, Northborough Fire Department, MA [U]

Karen E. Lehtonen, LION Group, Inc., OH [M]

David G. Matthews, Fire & Industrial (PPE) Ltd., United Kingdom [SE]
Rep. International Standards Organization

Benjamin Mauti, Globe Manufacturing/Mine Safety Appliances Company, PA [M]

Michael F. McKenna, Michael McKenna & Associates, LLC, CA [SE]

Douglas Menard, Boston Fire Department, MA [U]

John H. Morris, 3M Company, GA [M]

Amanda H. Newsom, UL LLC, NC [RT]

Stephen R. Sanders, ASTM/Safety Equipment Institute (SEI), VA [RT]

Jeffrey O. Stull, International Personnel Protection, Inc., TX [M]

Jonathan V. Szalajda, National Institute for Occupational Safety & Health, PA [E]

Robert D. Tutterow, Jr., Fire Industry Education Resource Organization (FIERO), NC [U]
Rep. NFPA Fire Service Section

William A. Van Lent, Veridian Ltd., Inc., IA [M]
Rep. Fire & Emergency Manufacturers & Services Association

Bruce H. Varner, BHVarner & Associates, AZ [M]
Rep. International Fire Service Training Association

Dick Weise, Los Angeles County Fire Department/Safer, CA [U]

Harry P. Winer, HIP Consulting LLC, MA [SE]

Alternates

David T. Bernzweig, Columbus (OH) Division of Fire, OH [L]
(Alt. to Rick L. Swan)

Louis Carpentier, Innotex Inc., Canada [M]
(Alt. to William A. Van Lent)

Robin B. Childs, US Department of Defense, VA [E]
(Alt. to Beth C. Lancaster)

Patricia A. Freeman, Globe Manufacturing Company, LLC/Mine Safety Appliances Company (MSA), NH [M]
(Alt. to Benjamin Mauti)

Daniel Glucksman, International Safety Equipment, VA [M]
(Alt. to Cristine Z. Fargo)

Kenneth Hayes, Boston Fire Department, MA [U]
(Alt. to Douglas Menard)

Pamela A. Kavalesky, Intertek Testing Services, NY [RT]
(Alt. to Jason L. Allen)

Judge W. Morgan, 3M Scott Safety, NC [M]
(Alt. to John H. Morris)

Gary L. Neilson, Sparks, NV [U]
(Alt. to Robert D. Tutterow, Jr.)

Jeffrey Peterson, National Institute for Occupational Safety & Health (NIOSH), PA [E]
(Alt. to Jonathan V. Szalajda)

Kevin M. Roche, Facets Consulting, AZ [M]
(Alt. to Bruce H. Varner)

Russell Shephard, Australasian Fire & Emergency Service Authorities Council, Australia [SE]
(Alt. to David G. Matthews)

David P. Stoddard, Michael McKenna & Associates, LLC, CA [SE]
(Alt. to Michael F. McKenna)

Grace G. Stull, International Personnel Protection, Inc., TX [M]
(Alt. to Jeffrey O. Stull)

Donald B. Thompson, North Carolina State University, NC [SE]
(Alt. to Roger L. Barker)

Jian Xiang, The DuPont Company, Inc., VA [M]
(Alt. to Diane B. Hess)

Nonvoting

Robert J. Athanas, SAFE-IR, Incorporated, NY [SE]
Rep. TC on Electronic Safety Equipment

Christina M. Baxter, Emergency Response Tips, LLC, FL [U]
Rep. TC on Hazardous Materials PC&E

Tricia L. Hock, ASTM/Safety Equipment Institute (SEI), VA [RT]
Rep. TC on Emergency Medical Services PC&E

Jeremy Metz, West Metro Fire Rescue, CO [U]
Rep. TC on Special Operations PC&E

Stephen T. Miles, National Institute for Occupational Safety & Health, WV [E]
Rep. TC on Respiratory Protection Equipment

Brian Montgomery, US Department of Justice, DC [E]
Rep. Tactical and Technical Operations Respiratory Protection Equipment

Tim W. Tomlinson, Addison Fire Department, TX [C]
Rep. TC on Structural and Proximity Fire Fighting PC&E

Chris Farrell, NFPA Staff Liaison

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Committee Scope: This Committee shall have primary responsibility for documents on the design, performance, testing, and certification of protective clothing and protective equipment manufactured for fire and emergency services organizations and personnel, to protect against exposures encountered during emergency incident operations. This Committee shall also have the primary responsibility for documents on the selection, care, and maintenance of such protective clothing and protective equipment by fire and emergency services organizations and personnel.

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West Metro Fire Rescue, CO [U]

Karen E. Lehtonen, *Secretary*
LION Group, Inc., OH [M]

Jason L. Allen, Intertek Testing Services, NY [RT]
Joseph Arrington, San Antonio Fire Department, TX [U]
Richard J. Broccolo, Orange County Fire Rescue, FL [U]
Paul Dacey, W. L. Gore & Associates, Inc., MD [M]
Keith B. Dempsey, City of Dalton Fire Department, GA [C]
Josh Farris, Central Pierce Fire And Rescue, WA [U]
Richard Galtieri, Port Of Seattle Fire Department, WA [U]
Richard Garber, Anne Arundel County Fire Department, PA [U]
Rep. Lancaster County
Stephen J. Geraghty, Fire Department City of New York (FDNY), NY [U]
Diane B. Hess, PBI Performance Products, Inc., NC [M]
Tricia L. Hock, ASTM/Safety Equipment Institute (SEI), VA [RT]
Thomas Howard, New York Division of Homeland Security & Emergency Services, NY [E]
Richard Kesler, Illinois Fire Service Institute, IL [SE]
Kim Klaren, Fairfax County Fire & Rescue Department, VA [U]
Stephen Legros, City of Yuma Fire Department, AZ [U]
Loui McCurley, PMI, CO [M]
Craig P. Mignogno, Columbus Firefighters Union, IAFF67, OH [L]
Rep. Columbus Firefighters Union
Amanda H. Newsom, UL LLC, NC [RT]
H. Dean Paderick, Special Rescue International, VA [SE]
Matthew Gerald Plunkett, E.D. Bullard Company, KY [M]
John F. Rihn, Globe Manufacturing/Mine Safety Appliances Company, PA [M]
Mark S. Saner, VF Imagewear/Bulwark Protective Apparel, CA [M]
Cedric Smith, CMC Rescue, Inc., CA [M]
Michael T. Stanhope, TenCate/Southern Mills, Inc., GA [M]
Jay L. Tarley, National Institute for Occupational Safety & Health, WV [E]

Alternates

Brian J. Beechner, Orange County Fire Rescue Department, FL [U]
(Alt. to Richard J. Broccolo)
Jeffrey S. Bowles, PMI Denver, CO [M]
(Alt. to Loui McCurley)
Jamey B. Brads, Virginia Department of Fire Programs (VDFP), VA [SE]
(Alt. to H. Dean Paderick)
Charles S. Dunn, TenCate Protective Fabrics/Southern Mills, GA [M]
(Alt. to Michael T. Stanhope)
Gregory Gould, New York State Division of Homeland Security & Emergency Services-OFPC, NY [E]
(Alt. to Thomas Howard)
Daniel Hudson, City of Dalton Fire Department, GA [C]
(Alt. to Keith B. Dempsey)
Joshua Ingram, PBI Performance Products, NC [M]
(Alt. to Diane B. Hess)
Pamela A. Kavalesky, Intertek Testing Services, NY [RT]
(Alt. to Jason L. Allen)
George R. Krause, II, Globe Manufacturing Company, Inc., NH [M]
(Alt. to John F. Rihn)
John McKently, CMC Rescue, Inc., CA [M]
(Alt. to Cedric Smith)
Dean D. Moran, ASTM/Safety Equipment Institute (SEI), VA [RT]
(Alt. to Tricia L. Hock)
James E. Murray, Fire Department City of New York (FDNY), NY [U]
(Alt. to Stephen J. Geraghty)
Jeffrey D. Palcic, National Institute for Occupational Safety and Health, PA [E]
(Alt. to Jay L. Tarley)
Jon Saito, West Metro Fire Rescue, CO [U]
(Alt. to Jeremy Metz)
Kimberly Schoppa, Fairfax County Fire And Rescue, VA [U]
(Alt. to Kim Klaren)
Ashley M. Scott, LION Group, Inc., OH [M]
(Alt. to Karen E. Lehtonen)
Beverly Wooten Stutts, UL LLC, NC [RT]
(Alt. to Amanda H. Newsom)

Chris Farrell, NFPA Staff Liaison

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Committee Scope: This Committee shall have primary responsibility for documents on special operations protective clothing and protective equipment, except respiratory equipment, that provides hand, foot, torso, limb, head, and interface protection for fire fighters and other emergency services responders during incidents involving special operations functions including, but not limited to, structural collapse, trench rescue, confined space entry, urban search and rescue, high angle/mountain rescue, vehicular

extraction, swift water or flooding rescue, contaminated water diving, and air operations. This Committee shall also have primary responsibility for documents on station/work uniform garments that are not of themselves primary protective garments but can be combined with a primary protective garment to serve dual or multiple functions. Additionally, this Committee shall have primary responsibility for documents on the selection, care, and maintenance of special operations protective clothing and equipment by fire and emergency services organizations and personnel.

Technical Committee on Technical Search and Rescue

Ben Waller, *Chair*
Tennessee Association of Rescue Squads, SC [SE]

George A. Bassler, New York State Office of Fire Prevention & Control, NY [E]
Jamey B. Brads, Virginia Department of Fire Programs (VDFP), VA [U]
Francis J. Brennan, Seattle Fire Department, WA [E]
Roger E. Bryant, Logan County Emergency Ambulance Authority, WV [E]
Alberto Burrero, Special Rescue Operations Inc., Canada [M]
Donald C. Cooper, Ohio Division of State Fire Marshal, OH [E]
John Dennis, Dynamic Rescue Systems, Canada [SE]
Paul A. Doughty, Providence Fire Fighters Local 799, RI [L]
Leslie D. English, Grove Hill, AL [SE]
Deano G. Esades, Pechanga Fire Department, CA [U]
Joseph P. (Pete) Gannon, Dive Rescue International, FL [SE]
Stephen J. Geraghty, Fire Department City of New York (FDNY), NY [E]
Eric Grootendorst, Vancouver Fire Rescue/JIBC, Canada [L]
Rep. Justice Institute of British Columbia
Hector Hernandez, Los Angeles Fire Department, CA [E]
Bruce Hodges, North Carolina Office of the State Fire Marshal, NC [E]
Ihor M. Holowczynsky, Winnipeg Fire Paramedic Service, Canada [SE]
Jonathan B. Kohan, Atlantic Beach Rescue Squad, NY [U]
Timothy A. Kovacs, Phoenix Fire Department, AZ [U]
Colin Legrow, Technical Rope Rescue Inc., Canada [U]
Glenn E. Mate, Monroe Fire Marshal's Office, CT [E]
Loui McCurley, PMI, CO [M]
John McKently, CMC Rescue, Inc., CA [M]
Ralph McNemar, West Virginia University Fire Service Extension/ Gauley Bridge Volunteer Fire Department , WV [U]
Rep. National Volunteer Fire Council
John P. O'Connell, Collapse Rescue Systems Inc., NY [SE]
Brandi K. Phillips, University Of Florida, FL [SE]
Eric J. Rickenbach, Pennsylvania State University, PA [SE]
Peter M. Schecter, Oakland Park, FL [U]
Andrew Speier, McLane-Black Lake Fire Department, WA [U]
Dustin Spires, Madison Fire And Rescue, AL [L]
Rep. International Association of Fire Fighters
Richard Wright, Wright Rescue Solutions, Inc., FL [SE]

Alternates

Jeffrey S. Bowles, PMI Denver, CO [M]
(Alt. to Loui McCurley)
Eric D. Creel, City of Mobile Fire Rescue, VA [SE]
(Alt. to Leslie D. English)
Joshua Fleming, University Of Florida, FL [SE]
(Alt. to Brandi K. Phillips)
Justin Fox, Dive Rescue International, CO [SE]
(Alt. to Joseph P. (Pete) Gannon)
Timothy Joseph Gleason, City of Miami Fire Department, FL [U]
(Alt. to Jonathan B. Kohan)
David Craig Jernigan, Panama City Fire Department, FL [SE]
(Alt. to Richard Wright)
Johnny A. Mason, Great Oaks Public Safety, OH [U]
(Alt. to Ralph McNemar)
Jay McCallum, Chicago Fire Department, IL [U]
(Voting Alt.)
Tamalyn Nigretto, Seattle Fire Department, WA [E]
(Alt. to Francis J. Brennan)
William Simmes, New York State Division Homeland Security, NY [E]
(Alt. to George A. Bassler)
Brian A. Wade, North Carolina Office of the State Fire Marshal, NC [E]
(Alt. to Bruce Hodges)

Ken Holland, NFPA Staff Liaison

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Committee Scope: This Committee shall have primary responsibility for documents on technical search and rescue techniques, operations, and procedures to develop efficient, proper, and safe utilization of personnel and equipment.

Contents

NFPA 2500

Standard for

Operations and Training for Technical Search and Rescue Incidents and Life Safety Rope and Equipment for Emergency Services

2022 Edition

NOTICE: An asterisk (*) following the number or letter designating a paragraph indicates that explanatory material on the paragraph can be found in Annex A.

A reference in brackets [ ] following a section or paragraph indicates material that has been extracted from another NFPA document. Extracted text may be edited for consistency and style and may include the revision of internal paragraph references and other references as appropriate. Requests for interpretations or revisions of extracted text shall be sent to the technical committee responsible for the source document.

Information on referenced and extracted publications can be found in Chapter 2 and Annex L.

Chapter 1 Administration

1.1 Scope. This standard provides minimum requirements for conducting operations at technical search and rescue incidents, for the design, performance, testing, and certification of life safety rope and equipment for emergency services, and for the selection, care, and maintenance of rope and associated equipment for emergency services personnel.

1.2 Purpose. The purpose of this standard is to specify minimum requirements for the following:

(1) Identifying and establishing levels of functional capability for conducting operations at technical search and rescue incidents while minimizing threats to rescuers
(2) Establishing minimum levels of performance for life safety rope, escape and fire escape rope, escape and fire escape webbing, water rescue throwlines, moderate elongation laid life-saving rope, manufacturer-supplied eye terminations, life safety harnesses, belts, victim extrication devices, end-to-end and multiple configuration straps, belay devices, carabiners and snap links, descent control devices, escape anchors, litters, portable anchors, pulleys, rope grab and ascending devices, escape and fire escape systems, manufactured systems, and other auxiliary equipment for emergency services personnel
(3) Establishing a program for life safety rope and equipment to reduce the risks and hazards when used for emergency services

1.3* Application. This standard can be applied as follows:

(1) Chapters 1 through 3, 4 through 23, and Annexes A through J constitute the 2022 edition of NFPA 1670.
(2) Chapters 1 through 3, 24 through 28, and Annexes A and K constitute the 2022 edition of NFPA 1983.
(3) Chapters 1 through 3, 29 through 35, and Annex A constitute the 2022 edition of NFPA 1858.

1.4* Units. Values for measurement are followed by an equivalent in parentheses, but only the first stated value shall be regarded as the requirement.

Chapter 2 Referenced Publications

2.1 General. The documents or portions thereof listed in this chapter are referenced within this standard and shall be considered part of the requirements of this document.

2.2 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 470, *Hazardous Materials Standards for Responders,* 2022 edition.

NFPA 1006, *Standard for Technical Rescue Personnel Professional Qualifications,* 2021 edition.

NFPA 1091, *Standard for Traffic Incident Management Personnel Professional Qualifications,* 2019 edition.

NFPA 1500™, *Standard on Fire Department Occupational Safety, Health, and Wellness Program,* 2021 edition.

NFPA 1561, *Standard on Emergency Services Incident Management System and Command Safety,* 2020 edition.

NFPA 1971, *Standard on Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting,* 2018 edition.

NFPA 1983, *Standard on Life Safety Rope and Equipment for Emergency Services,* 2017 edition.

2.3 Other Publications.

2.3.1 AATCC Publications. American Association of Textile Chemists and Colorists, P.O. Box 12215, Research Triangle Park, NC 27709.

AATCC 135, *Dimensional Changes of Fabrics after Home Laundering,* 2004.

2.3.2 ASTM Publications. ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.

ASTM B117, *Standard Practice for Operating Salt Spray (Fog) Apparatus,* 2019.

ASTM D4966, *Standard Test Method for Abrasion Resistance of Textile Fabrics (Martindale Abrasion Tester Method),* 2012, reapproved 2016.

ASTM D6413/D6413M, *Standard Test Method for Flame Resistance of Textiles (Vertical Test),* 2015.

ASTM D7138, *Standard Test Method to Determine Melting Temperature of Synthetic Fibers*, 2016.

ASTM E794, *Standard Test Method for Melting and Crystallization Temperatures by Thermal Analysis*, 2006, reapproved 2018.

ASTM F1740, *Standard Guide for Inspection of Nylon, Polyester, or Nylon/Polyester Blend, or Both Kernmantle Rope*, 1996, reapproved 2018.

ASTM F1772, *Standard Specification for Harnesses for Rescue and Sport Activities,* 2017.

ASTM F1956, *Standard Specification for Rescue Carabiners*, 2020.

ASTM F2436, *Standard Test Method for Measuring the Performance of Synthetic Rope Rescue Belay Systems Using a Drop Test,* 2014, reapproved 2019.

ASTM F2821, *Standard Test Methods for Basket Type Rescue Litters,* 2015, reapproved 2020.

ASTM F2894, *Standard Test Method for Evaluation of Materials, Protective Clothing and Equipment for Heat Resistance Using a Hot Air Circulating Oven*, 2019.

2.3.3 CGA Publications. Compressed Gas Association, 14501 George Carter Way, Suite 103, Chantilly, VA 20151.

ANSI/CGA G7.1, *Commodity Specification for Air*, 2018.

2.3.4 Cordage Institute Publications. The Cordage Institute, 994 Old Eagle School Road, Suite 1019, Wayne, PA 19087.

CI 1202, *Terminology for Fiber Rope*, 2013.

CI 1800, *Test Methods for Life Safety Rope and Accessory Cords for Life Safety Applications*, 2017.

CI 1801, *Performance Requirements for Low Stretch and Static Life Safety Rope*, 2017.

CI 1805, *3-Strand Life Safety Rope, Moderate Stretch*, 2018.

2.3.5 ISO Publications. International Organization for Standardization, ISO Central Secretariat, BIBC II, Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland.

ISO Guide 27, *Guidelines for corrective action to be taken by a certification body in the event of misuse of its mark of conformity*, 1983, reconfirmed 2014.

ISO 9001, *Quality management systems — Requirements*, 2015.

ISO 17011, *Conformity assessment – Requirements for accreditation bodies accrediting conformity assessment bodies*, 2017.

ISO/IEC 17021, *Conformity assessment — Requirements for bodies providing audit and certification of management systems — Part 1: Requirements*, 2015.

ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories*, 2017.

ISO/IEC 17065, *Conformity assessment — Requirements for bodies certifying products, processes, and services*, 2012, reconfirmed 2018.

ISO 22159, *Personal equipment for protection against falls — Descending devices*, 2007.

2.3.6 SAE Publications. SAE International, Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale, PA 15096.

SAE AMS-2175A, *Castings, Classification and Inspection of,* 2003, reaffirmed 2018.

2.3.7 UL Publications. Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096.

UL 913, *Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, III, Division 1, Hazardous (Classified) Locations*, 2013, revised 2018.

2.3.8 US Government Publications. US Government Publishing Office, 732 North Capitol Street, NW, Washington, DC 20401-0001.

"FEMA National Response Framework," US Department of Homeland Security, 2016.

"FEMA National Urban Search and Rescue (US&R) Response System" Fact Sheet, US Department of Homeland Security, 2015.

MIL-DTL-83420N, Detail Specification: Wire Rope, Flexible, for Aircraft Control, General Specification for 1 March 2016.

National Search and Rescue Plan of the United States, US Coast Guard National Search and Rescue Committee, 2007.

2.3.9 Additional Publications.

Merriam-Webster's Collegiate Dictionary, 11th edition, Merriam-Webster, Inc., Springfield, MA, 2003.

2.4 References for Extracts in Mandatory Sections.

NFPA 1006, *Standard for Technical Rescue Personnel Professional Qualifications,* 2021 edition.

NFPA 1021, *Standard for Fire Officer Professional Qualifications,* 2020 edition.

NFPA 1521, *Standard for Fire Department Safety Officer Professional Qualifications,* 2020 edition.

NFPA 1561, *Standard on Emergency Services Incident Management System and Command Safety,* 2020 edition.

NFPA 1855, *Standard on Selection, Care, and Maintenance of Protective Ensembles for Technical Rescue Incidents,* 2018 edition.

Chapter 3 Definitions

3.1 General. The definitions contained in this chapter shall apply to the terms used in this standard. Where terms are not defined in this chapter or within another chapter, they shall be defined using their ordinarily accepted meanings within the context in which they are used. *Merriam-Webster's Collegiate Dictionary*, 11th edition, shall be the source for the ordinarily accepted meaning.

3.2 NFPA Official Definitions.

3.2.1* Approved. Acceptable to the authority having jurisdiction.

3.2.2* Authority Having Jurisdiction (AHJ). An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure.

3.2.3 Labeled. Equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the authority having jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled equipment or materials, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.

3.2.4* Listed. Equipment, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services, and whose listing states that either the equipment, material, or service meets appropriate designated standards or has been tested and found suitable for a specified purpose.

3.2.5 Shall. Indicates a mandatory requirement.

3.2.6 Should. Indicates a recommendation or that which is advised but not required.

3.2.7 Standard. An NFPA Standard, the main text of which contains only mandatory provisions using the word "shall" to indicate requirements and that is in a form generally suitable for mandatory reference by another standard or code or for adoption into law. Nonmandatory provisions are not to be considered a part of the requirements of a standard and shall be located in an appendix, annex, footnote, informational note, or other means as permitted in the NFPA Manuals of Style. When used in a generic sense, such as in the phrase "standards development process" or "standards development activities," the term "standards" includes all NFPA Standards, including Codes, Standards, Recommended Practices, and Guides.

3.3 General Definitions.

3.3.1 Acceptable Entry Conditions. Conditions that must exist in a space to allow entry and to ensure that employees can safely enter into and work within the space.

3.3.2 Adjusting Device. See 3.3.49.1.

3.3.3 Alternate Air Source. A secondary air supply source system that involves an alternate second-stage regulator provided by either a separate dedicated second-stage or a multipurpose second-stage regulator coupled with a buoyancy compensator inflator valve.

3.3.4 Anchor Point. A single, structural component used either alone or in combination with other components to create an anchor system capable of sustaining the actual and potential load on the rope rescue system.

3.3.5 Anchor System. One or more anchor points rigged in such a way as to provide a structurally significant connection point for rope rescue system components.

3.3.6 Animal Technical Rescue. Rescuing of an animal requiring technical skills; not to be confused with "animal rescue" which typically refers to abuse or neglect.

3.3.7 Ascending Device. See 3.3.49.2.

3.3.8 Ascending (Line). A means of safely traveling up a fixed line with the use of one or more ascent devices.

3.3.9 Assessment Phase (Size-Up). The process of assessing the conditions, the scene, and the subject's condition and ability to assist in his or her own rescue.

3.3.10 Attachment Point.

3.3.10.1* *Load-Bearing Attachment Point.* Point on a harness, victim extrication device, or escape belt that is used for connection to an anchor system that will provide full support and fall arrest for the designed load.

3.3.10.2* *Positioning Attachment Point.* Point on a harness or belt that is used for connection to an anchor system that will support a person's weight for work at height.

3.3.11 Auxiliary Equipment. Equipment items that are load-bearing and designed to be utilized with life safety rope and harness.

3.3.12* Avalanche. A mass of snow — sometimes containing ice, water, and debris — that slides down a mountainside.

3.3.13* Belay. The method by which a potential fall distance is controlled to minimize damage to equipment and/or injury to a live load.

3.3.14 Belay Device. See 3.3.49.3.

3.3.15 Belay System. A belay device and any other components required for the belay device to function.

3.3.16 Bell-Bottom Pier Hole. A type of shaft or footing excavation, the bottom of which is made larger than the cross-section above to form a bell shape.

3.3.17 Belt. Compliant equipment items configured as devices that fasten around the waist only and designated as ladder belts or escape belts.

3.3.17.1* *Escape Belt.* A belt that is intended for use by the wearer only as an emergency self-rescue device.

3.3.17.2 *Ladder Belt.* A belt that is intended for use as a positioning device for a person on a ladder.

3.3.18 Benching or Benching System. A method of protecting employees from cave-ins by excavating the side of an excavation to form one or a series of horizontal levels or steps, usually with vertical or near-vertical surfaces between levels.

3.3.19 Bend. A knot that joins two ropes or webbing pieces together.

3.3.20 Block Creel Construction. See 3.3.186.1.

3.3.21 Body Fluids. Fluids that are produced by the body, including, but not limited to, blood, semen, mucus, feces, urine, vaginal secretions, breast milk, amniotic fluids, cerebrospinal fluid, synovial fluid, and pericardial fluid.

3.3.22* Body Substance Isolation. An infection control strategy that considers all body substances potentially infectious. It utilizes procedures and equipment to protect the responder from communicable diseases that are known to be transmitted through blood and other body substances.

3.3.23 Buckle. A load-bearing connector that is an integral part of an auxiliary equipment item and used to connect two pieces of webbing.

3.3.24 Buoyancy Compensator (BCD). Device worn by a diver containing a bladder that is inflated or deflated by the diver to manage their buoyancy while immersed in a liquid.

3.3.25 Carabiner. An auxiliary equipment system item consisting of a load-bearing connector with a self-closing gate used to join other components.

3.3.26 Care. Cleaning and storage of protective clothing and equipment.

3.3.27* Cave. A natural underground void formed by geologic process. [**1006,** 2021]

3.3.28 Cave-In. The separation of a mass of soil or rock material from the side of an excavation or trench, or the loss of soil from under a trench shield or support system, and its sudden movement into the excavation, either by falling or sliding, in sufficient quantity so that it could entrap, bury, or otherwise injure and immobilize a person.

3.3.29 Certification/Certified. A system whereby a certification organization determines that a manufacturer has demonstrated the ability to produce a product that complies with the requirements of this standard, authorizes the manufacturer to use a label on listed products that comply with the requirements of this standard, and establishes a follow-up program conducted by the certification organization as a check on the methods the manufacturer uses to determine compliance with the requirements of this standard.

3.3.30 Certification Organization. An independent, third-party organization that determines product compliance with the requirements of this standard with a labeling/listing/follow-up program.

3.3.31* Cleaning. The act of removing soiling and contamination from ensembles and ensemble elements by mechanical, chemical, thermal, or combined processes.

3.3.32 Collapse Safety Zone. An area around a collapsed structure or structures that is outside the potential collapse zone of falling debris.

3.3.33 Compass. A device that uses the earth's magnetic field to indicate relative direction.

3.3.34 Competent Person. One who is capable of identifying existing and predictable hazards in the surroundings or working conditions that are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them. [**1006,** 2021]

3.3.35 Compliant. Certified as meeting or exceeding all applicable requirements of this standard.

3.3.36* Confined Space. A space that is large enough and so configured that a person can enter and perform assigned work, that has limited or restricted means for entry or exit (e.g., tanks, vessels, silos, storage bins, hoppers, vaults, and pits), and that is not designed for continuous human occupancy.

3.3.37 Confined Space Rescue Service. The confined space rescue team designated by the AHJ to rescue victims from within confined spaces, including operational and technical levels of industrial, municipal, and private sector organizations.

3.3.38 Confined Space Rescue Team. A combination of individuals trained, equipped, and available to respond to confined space emergencies.

3.3.39 Contamination/Contaminated. The process by which life safety rope and equipment are exposed to hazardous materials and body fluids.

3.3.40 Continuous Filament Fiber. See 3.3.83.1.

3.3.41 Corrosion. A condition exhibiting any signs of deterioration, including pitting or loss of metal.

3.3.42* Coverage (sometimes called "coverage factor"). A relative measure of how thoroughly an area has been searched or "covered."

3.3.43 Cribbing. Short lengths of timber/composite materials, usually 4 in. × 4 in. (101.60 mm × 101.60 mm) and 18 in. – 24 in. (457.20 mm – 609.60 mm) long, that are used in various configurations to stabilize loads in place or while load is moving.

3.3.44* Critical Angle. A deflection in two rope rescue system components that increases any force vector beyond that which is acceptable.

3.3.45* Decontamination. The act of removing contamination from or neutralizing contamination in protective clothing and equipment. *(See also 3.3.31, Cleaning.)*

3.3.46 Descending (Line). A means of safely traveling down a fixed line using a descent control device.

3.3.47 Descent Control Device. See 3.3.49.4.

3.3.48 Design Load. See 3.3.121.1.

3.3.49 Device.

3.3.49.1 ***Adjusting Device.*** An auxiliary equipment system component; a connector device that allows adjustment to be made to a piece of equipment.

3.3.49.2* ***Ascending Device.*** A type of rope grab; auxiliary equipment; a friction or mechanical device utilized to allow ascending a fixed line.

3.3.49.3 ***Belay Device.*** An auxiliary equipment item used to catch a falling load by grabbing the rope.

3.3.49.4 ***Descent Control Device.*** An auxiliary equipment item; a friction or mechanical device utilized with rope to control descent.

3.3.49.4.1 ***Escape Descent Control Device.*** An auxiliary equipment system component; a friction or mechanical device utilized with escape line to control descent.

3.3.49.5* ***Escape Anchor Device.*** An auxiliary equipment device that connects to the structure and supports an escape line.

3.3.49.6 ***Rope Grab Device.*** An auxiliary equipment device used to grasp a life safety rope for the purpose of supporting loads; includes ascending devices.

3.3.49.7 ***Victim Extrication Device.*** A device designed to be secured about the body of a victim in a harness-like manner to provide support in a head-up or horizontal configuration for the purpose of lifting and transporting the victim with a life safety rope.

3.3.50 Diameter (Rope). See 3.3.186.2.

3.3.51 Disentanglement. The cutting of a vehicle and/or machinery away from trapped or injured victims.

3.3.52 Dive. Exposure of an individual to a hyperbaric environment.

3.3.53 Dive Profile. Description and documentation of a diver's potential or actual exposure to a hyperbaric environment, which includes depth, duration of exposure, and, where applicable, intervals between exposures, which is intended to document and communicate the diver's nitrogen load.

3.3.54 Dive Supervisor. The member of a dive team who has the authority and expertise to manage and direct all aspects of the dive operation and has been trained to meet all nondiving job performance requirements of technician-level dive rescue as defined in NFPA 1006.

3.3.55 Dive Tables. Tools used to calculate a diver's nitrogen loading based on depth, length of exposure to a hyperbaric environment, and intervals between exposures of an actual or a planned dive.

3.3.56 Dive Team. A collection of divers and trained support personnel acting under the direction of a single team leader who are trained and equipped to act collectively to achieve a subsurface mission using a common set of practices or guidelines.

3.3.57 Dive Tender. A member of the dive team who is responsible for assisting divers with assembly and donning of equipment, communicating with divers, tracking the diver's status and location, and managing subsurface search operations, and trained to meet all the job performance requirements of operations-level dive rescue as defined in NFPA 1006.

3.3.58 Diver. An individual exposed to a hyperbaric environment while using a compressed gas or supplied breathing gas system.

3.3.58.1* ***90 Percent Diver.*** A diver who is dressed, equipped, and positioned to quickly enter the water and assume the role of safety diver or otherwise assist the operation as necessary.

3.3.58.2* ***Safety Diver.*** A diver who is equipped and positioned to immediately submerge and lend assistance to a diver in distress or to engage in a search for a missing diver.

3.3.59 Edge Protection. A means of protecting software components within a rope rescue system from the potentially harmful effects of exposed sharp or abrasive edges.

3.3.60 Elongation. The increase in length, expressed in a percent of the original gauge length, that occurs in a sample of new rope when tested as specified herein.

3.3.61 Emergency Incident. Any situation to which an emergency services organization responds to deliver emergency services, including rescue, fire suppression, emergency medical care, special operations, law enforcement, and other forms of hazard control and mitigation. [**1561,** 2020]

3.3.62 Emergency Medical Service (EMS). The organization(s) responsible for the care and transport of sick and injured persons to an appropriate emergency care facility. Referred to as Emergency Services in U.S. federal confined space regulations.

3.3.63 End-to-End Straps. Straps with end connection points meant to be loaded in end-to-end fashion, including, but not limited to, pick-off straps, load-releasing straps, and vertical lifting straps.

3.3.64 Engulfment. The surrounding and effective capture of a person by a fluid (e.g., liquid, finely divided particulate) substance that can be aspirated to cause death by filling or plugging the respiratory system or that can exert enough force on the body to cause death by strangulation, constriction, or crushing.

3.3.65 Entry. The action by which a person passes into a confined space. Entry includes ensuing work or rescue activities in that environment and is considered to have occurred as soon as any part of the entrant's body breaks the plane of an opening into the space, trench, or excavation.

3.3.66* Entry Permit. A written or printed document, established by an employer, for nonrescue entry into confined spaces.

3.3.67 Entry Team. The group of individuals, with established communications and leadership, assigned to perform work or rescue activities beyond the opening of, and within, the space, trench, or excavation.

3.3.68* Environment. A collection of characteristics such as weather, altitude, and terrain contained in an area that are unique to a location.

3.3.69 Escape. Immediate self-rescue of a single fire or emergency services person from a life-threatening emergency situation, generally above ground, using system components or manufactured systems designed for self-rescue escape.

3.3.70 Escape Anchor Device. See 3.3.49.5.

3.3.71 Escape Belt. See 3.3.17.1.

3.3.72 Escape Descent Control Device. See 3.3.49.4.1.

3.3.73 Escape Rope. See 3.3.186.3.

3.3.74 Escape System. A system designed to provide a means of escape from an immediately hazardous environment, above grade, and intended only for emergency self-rescue.

3.3.74.1 ***Escape System.*** A system designed to be used for the purpose of self-rescue from an immediately hazardous environment; not intended for use in a hazardous environment involving fire or fire products.

3.3.74.2 ***Fire Escape System.*** A system designed to be used for the purpose of self-rescue from an immediately hazardous environment involving fire or fire products.

3.3.75 Escape Webbing. See 3.3.239.1.

3.3.76 Excavation. Any man-made cut, cavity, trench, or depression in an earth surface, formed by the removal of earth.

3.3.77 Extrication. The removal of trapped victims from a vehicle or machinery.

3.3.78 Face(s). The vertical or inclined earth surface formed as a result of excavation work.

3.3.79 Failure. The breakage, displacement, or permanent deformation of a structural member or connection so as to reduce its structural integrity and its supportive capabilities as it applies to structural collapse search and rescue operations.

3.3.80* Fall Factor. A measure of fall severity calculated by dividing the distance fallen by the length of rope used to arrest the fall.

3.3.81* FEMA Task Force Structure/Hazard Evaluation Marking System. Distinct markings made with international orange spray paint, after performing a building hazard identification, near a collapsed structure's most accessible point of entry.

3.3.82* FEMA Task Force Structure Marking System, Structure Identification Within a Geographic Area. Distinct markings made with international orange spray paint to label buildings with their street number so that personnel can differentiate one building from another.

3.3.83 Fiber.

3.3.83.1 ***Continuous Filament Fiber.*** Fiber of indefinite or unmeasurable length.

3.3.83.2 ***Virgin Fiber.*** Fiber that is new and previously unused.

3.3.84 Fire Escape Rope. See 3.3.186.3.1.

3.3.85 Fire Escape System. See 3.3.74.2.

3.3.86 Fire Escape Webbing. See 3.3.239.2.

3.3.87 Fixed Line (Fixed Line System). A rope rescue system consisting of a nonmoving rope attached to an anchor system.

3.3.88 Follow-Up Program. The sampling, inspections, tests, or other measures conducted by the certification organization on a periodic basis to determine the continued compliance of labeled and listed products that are being produced by the manufacturer to the requirements of this standard.

3.3.89 Force Multiplier. Any load, object, environmental factor, or system configuration that increases the load on the anchor system(s).

3.3.90 Full-Face Mask. A diving mask that covers the diver's entire face, includes a regulator for breathing, has separate inhalation and exhalation chambers, provides for defogging, free flow if the seal is broken, and provides for a communication module.

3.3.91* General Area. An area surrounding the incident site (e.g., collapsed structure or trench) whose size is proportional to the size and nature of the incident. Within the general area, access by people, heavy machinery, and vehicles is limited and strictly controlled.

3.3.92* General Use. One designation of equipment item or manufactured systems designed for general-use loads, technical-use loads, and escape based on design loads that are calculated and understood.

3.3.93* Hand. The feel of flexibility and smoothness of a rope when tying knots or running it through equipment.

3.3.94 Hardware. Nonfabric components of protective clothing or equipment including, but not limited to, those made of metal or plastic.

3.3.95 Hardware (Rope Rescue). Rigid mechanical auxiliary equipment that can include, but is not limited to, anchor plates, carabiners, and mechanical ascent and descent control devices.

3.3.96 Harness. See 3.3.116, Life Safety Harness.

3.3.97 Hasty Search. An initial deployment of search resources that involves a quick search of areas or segments likely to contain survivors.

3.3.98 Hazard Identification. The process of identifying situations or conditions that have the potential to cause injury to people, damage to property, or damage to the environment.

3.3.99 Hazardous Atmospheres. Any atmosphere that can expose personnel to the risk of death, incapacitation, injury, acute illness, or impairment of ability to self-rescue.

3.3.100 Heavy Object. An item of such size and weight that it cannot be moved without the use of power tools (e.g., hydraulic lifting devices) or complex mechanical advantage systems.

3.3.101 High Angle. Refers to an environment in which the load is predominantly supported by the rope rescue system.

3.3.102 Hitch. A knot that attaches to or wraps around an object so that when the object is removed, the knot will fall apart.

3.3.103 Immediately Dangerous to Life or Health (IDLH). Any condition that would pose an immediate or delayed threat to life, cause irreversible adverse health effects, or interfere with an individual's ability to escape unaided from a hazardous environment.

3.3.104 Imminent Hazard. An act or condition that is judged to present a danger to persons or property and is so immediate and severe that it requires immediate corrective or preventive action.

3.3.105 Impact Load. See 3.3.121.2.

3.3.106 Incident Command System (ICS). The combination of facilities, equipment, personnel, procedures, and communications operating within a common organizational structure that has responsibility for the management of assigned resources to effectively accomplish stated objectives pertaining to an incident or training exercise.

3.3.107 Incident Management System (IMS). A system that defines the roles and responsibilities to be assumed by personnel and the operating procedures to be used in the management and direction of emergency operations; the system is also referred to as an incident command system (ICS). [**1021,** 2020]

3.3.108 Incident Response Plan. Written procedures, including standard operating guidelines, for managing an emergency response and operation.

3.3.109* Incident Scene. The location where activities related to a specific incident are conducted.

3.3.110* Isolation System. An arrangement of devices, including isolation devices, applied with specific techniques, that collectively serve to isolate a victim of a trench or excavation emergency from the surrounding product (e.g., soil, gravel, or sand).

3.3.111* Knot. A fastening made by tying rope or webbing in a prescribed way.

3.3.112 Ladder Belt. See 3.3.17.2.

3.3.113* Large Animal. Domesticated livestock including, but not limited to, horses, cows, mules, donkeys, goats, llamas, alpacas, pigs, and excluding wild animals and household pets.

3.3.114 Large Machinery. Complex machines (or machinery systems) constructed of heavy materials, not capable of simple disassembly, and presenting multiple concurrent hazards (e.g.,

control of energy sources, HAZMAT, change in elevation, multiple rescue disciplines, etc.), complex victim entrapment, or partial or complete amputation, and requiring the direct technical assistance of special experts in the design, maintenance, or construction of the device or machine.

3.3.115 Laser Target. A square or rectangular plastic device used in conjunction with a laser instrument to set the line and grade of pipe.

3.3.116 Life Safety Harness. An equipment item; an arrangement of materials secured about the body to support a person.

3.3.117 Life Safety Rope. See 3.3.186.4.

3.3.118 Line. See generic term for rope or webbing.

3.3.119 Litter. A transfer device designed to support and protect a victim during movement.

3.3.120 Litter Tender. A person who both accompanies and physically manages the litter.

3.3.121 Load.

3.3.121.1* *Design Load.* The load for which a given piece of equipment or manufactured system was engineered for under normal static conditions.

3.3.121.2* *Impact Load.* Sudden application of a force, which causes kinetic energy and momentum to be converted into other forms of energy.

3.3.121.3* *Proof Load.* The application of force to a material as a nondestructive test to verify the performance of that material.

3.3.122 Load-Bearing Attachment Point. See 3.3.10.1.

3.3.123 Load-Bearing Connector. An auxiliary equipment system component; a device used to join other system components including, but not limited to, carabiners, rings, quick links, and snap links.

3.3.124* Lockout. A method for keeping equipment from being set in motion and endangering workers. *(See also 3.3.219, Tagout.)*

3.3.125 Lot.

3.3.125.1 *Manufacturer's Lot.* An identifiable series of products that can be the same as or a subset of a production lot; used by the manufacturer for quality control or identification purposes.

3.3.125.2 *Production Lot.* An identifiable series of products manufactured with identical design specifications and identical materials and produced without any alterations to technique or procedure.

3.3.126 Low Angle. Refers to an environment in which the load is predominantly supported by itself and not the rope rescue system (e.g., flat land or mild sloping surface).

3.3.127* Lowering System. A rope rescue system used to lower a load under control.

3.3.128 Machine. Human-made system or device made up of fixed and moving parts that perform a task.

3.3.129 Machinery. The moving parts of a particular machine.

3.3.130 Manufactured System. Preassembled system sold as a unit by the manufacturer and tested as a complete assembly.

3.3.131 Manufacturer. The entity that assumes the liability for the compliant product.

3.3.132* Manufacturer-Supplied Eye Termination. A point of fixed or permanent connection to compliant escape line, life safety rope, throwline, or moderate elongation laid rope, other than a knot, provided by the manufacturer for the purpose of connecting a load to a compliant product.

3.3.133 Manufacturer's Lot. See 3.3.125.1.

3.3.134 Manufacturing Facility. A facility that is involved in the production, assembly, final inspection, or labeling of the compliant end product.

3.3.135 Maximum Working Load. Weight supported by the life safety rope and system components that must not be exceeded.

3.3.136* Mechanical Advantage (M/A). A force created through mechanical means including, but not limited to, a system of levers, gearing, or ropes and pulleys usually creating an output force greater than the input force and expressed in terms of a ratio of output force to input force.

3.3.137 Melt. Response of a material to heat resulting in evidence of flowing or dripping.

3.3.138 Member. A person performing the duties and responsibilities of an emergency response organization on a full-time or part-time basis, with or without compensation.

3.3.139 Minimum Breaking Strength (MBS). The result of subtracting three standard deviations from the mean result of the lot being tested using the formula in 28.2.5.2.

3.3.140* Minimum Primary Reserve Pressure. Minimum permissible breathing gas pressure remaining in a SCUBA diver's primary delivery system on reaching the surface and establishing positive buoyancy.

3.3.141 Moderate Elongation Laid Life-Saving Rope. See 3.3.186.4.1.

3.3.142* Multiple Configuration Load Straps. Straps with end connection points that can be configured in multiple loading, including, but not limited to, end-to-end, basket, and choker configurations.

3.3.143* Multiple-Point Anchor System. System configuration providing load distribution over more than one anchor point, either proportionally or disproportionally. *(See also 3.3.5, Anchor System.)*

3.3.144* National Response Framework. An overview of key response principles, roles, and structures that guides the U.S. national response and that describes (a) how communities, states, the federal government, and private sector and nongovernmental partners apply these principles for a coordinated, effective national response; (b) special circumstances where the federal government exercises a larger role, including incidents where federal interests are involved and catastrophic incidents where a state would require significant support; and (c) how these elements come together and are implemented by first responders, decision makers, and supporting entities to provide a unified national response in the United States.

3.3.145* National Search and Rescue Plan. A document that identifies responsibilities of U.S. federal agencies and serves as the basis for the *National Search and Rescue Plan of the United States*, which discusses search and rescue organizations, resources, methods, and techniques utilized by the federal government.

3.3.146 Non-Fire Escape System. See 3.3.74.1, Escape System.

3.3.147 One-Call Utility Location Service. A service from which contractors, emergency service personnel, and others can obtain information on the location of underground utilities in any area.

3.3.148 Organization. The entity that provides the direct management and supervision for the emergency services personnel. [**1855,** 2018]

3.3.149 Oxygen-Deficient Atmosphere. Air atmospheres containing less than 19.5 percent oxygen by volume at one standard atmosphere pressure.

3.3.150 Oxygen-Enriched Atmosphere. Air atmospheres containing more than 23.5 percent oxygen by volume at one standard atmosphere pressure.

3.3.151 Packaging (Patient Packaging). The process of securing a subject in a transfer device, with regard to existing and potential injuries/illness, so as to avoid further harm during movement.

3.3.152 Panel Team. The group of individuals, with established communications and leadership, assigned to construct (if necessary), move, place, and manage panels (traditional sheeting panels) both inside and outside the space, trench, or excavation.

3.3.153* Personal Protective Equipment (PPE). The equipment provided to shield or isolate personnel from infectious, chemical, physical, and thermal hazards.

3.3.154 Personnel. Any individual participating within the incident scene.

3.3.155* Portable Anchor. A manufactured device with rigid arms, legs, or both designed to support human loads.

3.3.156 Positioning Attachment Point. See 3.3.10.2.

3.3.157 Predeployment Inspection. An inspection performed prior to making the item available for service.

3.3.158 Pre-Entry Briefing. Information passed to all personnel prior to entry into a confined space or trench/excavation environment.

3.3.159 Primary Access. The existing opening of doors and/or windows that provide a pathway to the trapped and/or injured victim(s).

3.3.160* Primary Search. A quick search of the structures likely to contain survivors.

3.3.161* Product Label. A label or marking affixed to a product by the manufacturer that provides general information, warnings, instructions for care and maintenance, and other information.

3.3.162 Production Lot. See 3.3.125.2.

3.3.163 Proof Load. See 3.3.121.3.

3.3.164* Protective System. A method of protecting employees from cave-ins, from material that could fall or roll from an excavation face or into an excavation, or from the collapse of adjacent structures.

3.3.165 Public Safety Diving. Underwater diving, related to team operations and training, performed by any member, group, or agency of a community or government-recognized public safety diving or water rescue team.

3.3.166 Pulley. A device designed to provide a change of direction for a line while minimizing loss of energy due to friction.

3.3.167* Raising System. A rope rescue system used to raise a load under control.

3.3.168 "Reach, Throw, Row, Go." The four sequential steps in water rescue with progressively more risk to the rescuer. Specifically, a "go" rescue involves physically entering the medium (e.g., in the water or on the ice).

3.3.169* Reconnaissance (Recon). A preliminary examination or survey; specifically, an examination of an area for the purpose of obtaining information necessary for directing search and rescue operations.

3.3.170 Recovery. Nonemergency operations carried out by responders to retrieve property or remains of victims.

3.3.171* Redundant Air System. A system composed of a compressed breathing gas source, pressure gauge, primary and secondary regulator, and a means of affixing the system to the diver so that it will not be dropped or dislodged; is completely independent of the diver's primary air system and is configured to be accessed without delay when the diver is under duress; and of sufficient capacity to permit the diver to ascend to the surface from the maximum recognized operational depth while complying with a prescribed ascent rate and any necessary safety stops.

3.3.172* Registered Professional Engineer. A person who is registered as a professional engineer in the state where the work is to be performed.

3.3.173 Rescue. Those activities directed at locating endangered persons at an emergency incident, removing those persons from danger, treating the injured, and providing for transport to an appropriate health care facility.

3.3.174* Rescue Area. An area surrounding the incident site (e.g., collapsed structure or trench) whose size is proportional to the hazards that exist.

3.3.175 Rescue Attendant. A person who is qualified to be stationed outside a confined space to monitor rescue entrants, summon assistance, and perform nonentry rescues.

3.3.176 Rescue Entrant. A person entering a confined space for the specific purpose of rescue.

3.3.177 Rescue Incident. An emergency incident that primarily involves the rescue of persons subject to physical danger and that could include the provision of emergency medical care, but not necessarily.

3.3.178 Rescue Shoring. The temporary stabilization or resupport of any part of, section of, or structural element within a structure which is physically damaged, missing, or where the

structure itself is partially or totally collapsed or in danger of collapsing.

3.3.179* Rescue Team. A combination of rescue-trained individuals who are equipped and available to respond to and perform technical rescues.

3.3.180 Rescue Team Leader. The person designated within the incident command system as rescue group/division officer responsible for direct supervision of the rescue team operations.

3.3.181 Retrieval (Confined Space or Hazardous Environment). Removal of entrant(s) for rescue not requiring entry into a confined space or hazardous environment.

3.3.182* Retrieval System. Combinations of rescue equipment used for nonentry (external) rescue of persons from confined spaces.

3.3.183 Ring. An auxiliary equipment system component; an ungated load-bearing connector.

3.3.184 Risk Assessment. An assessment of the likelihood, vulnerability, and magnitude of incidents that could result from exposure to hazards.

3.3.185* Risk/Benefit Analysis. A decision made by a responder based on a hazard identification and situation assessment that weighs the risks likely to be taken against the benefits to be gained for taking those risks.

3.3.186 Rope. A compact but flexible, torsionally balanced, continuous structure of fibers produced from strands that are twisted, plaited, or braided together and that serve primarily to support a load or transmit a force from the point of origin to the point of application.

3.3.186.1* *Block Creel Construction.* Rope constructed without knots or splices in the yarns, ply yarns, strands or braids, or rope.

3.3.186.2 *Diameter (Rope).* The length of a straight line through the center of the cross section of the rope.

3.3.186.3 *Escape Rope.* Rope dedicated solely for the purpose of supporting people during emergency self-escape (self-rescue); not intended for use in a hazardous environment involving fire or fire products; not classified as a life safety rope.

3.3.186.3.1 *Fire Escape Rope.* Rope dedicated solely for the purpose of supporting people during emergency self-rescue (self-escape) from an immediately hazardous environment involving fire or fire products; not classified as a life safety rope.

3.3.186.4* *Life Safety Rope.* Rope dedicated solely for the purpose of supporting people during rescue, fire-fighting, other emergency operations, or during training evolutions.

3.3.186.4.1 *Moderate Elongation Laid Life-Saving Rope.* Rope dedicated solely for the purpose of supporting people during rescue at fire-fighting operations or training evolutions.

3.3.186.5 *Line.* See 3.3.186, Rope or 3.3.239, Webbing.

3.3.186.5.1 *Throwline.* A floating rope that is intended to be thrown to a person during water rescues or as a tether for rescuers entering the water.

3.3.187 Rope Grab Device. See 3.3.49.6.

3.3.188 Rope Rescue Equipment. Components used to build rope rescue systems including life safety rope, life safety harnesses, and auxiliary equipment.

3.3.189 Rope Rescue System. A system comprised of rope rescue equipment and an appropriate anchor system intended for use in the rescue of a subject.

3.3.190 Routine Inspection. An inspection performed at least prior to using an item.

3.3.191 Safety Officer. An individual appointed by the AHJ as qualified to maintain a safe working environment.

3.3.192 Sample. The element, item, component, or composite that is conditioned for subsequent testing. An amount of the material, product, or assembly to be tested that is representative of the item as a whole. *(See also 3.3.206, Specimen.)*

3.3.193 Secondary Access. Openings created by rescuers that provide a pathway to trapped and/or injured victims.

3.3.194* Secondary Search. A detailed, systematic search of an area.

3.3.195 Self-Destructive Action. Interaction of materials in a manner that leads to deterioration.

3.3.196 Sheeting. The members of a shoring system that support the sides of an excavation and are in turn supported by other members of the shoring system.

3.3.197* Shield (or Shield System). A structure that is able to withstand the forces imposed on it by a cave-in and thereby protect employees within the structures.

3.3.198 Shoring Team. The group of individuals, with established communications and leadership, assigned to construct, move, place, and manage the shoring or shoring system inside a structure, space, trench, or excavation.

3.3.199 Single-Point Anchor System. An anchor system configuration utilizing a single anchor point to provide the primary support for the rope rescue system. A single-point anchor system includes those anchor systems that utilize one or more additional nonloaded anchor points as backup to the primary anchor point.

3.3.200 Size-Up. A mental process of evaluating the influencing factors at an incident prior to committing resources to a course of action.

3.3.201 Small Machine. Machinery or equipment capable of simple disassembly, or constructed of lightweight materials, presenting simple hazards, which are capable of being controlled by the rescuer(s).

3.3.202 Snap Link. An auxiliary equipment system component; a self-closing, gated, load-bearing connector.

3.3.203 Software. Flexible textile components of protective clothing or equipment, including, but not limited to, end-to-end straps and multiple configuration straps.

3.3.204* Soiling. The accumulation of sweat, dust, dirt, debris, and other nonhazardous materials on or in an ensemble or ensemble element that could degrade its performance or cause hygiene issues.

3.3.205 Special Operations. Those emergency incidents to which the responding agency responds that require specific and advanced technical training and specialized tools and equipment.

3.3.206 Specimen. The conditioned element, item, component, or composite that is tested. Specimens are taken from samples. *(See also 3.3.192, Sample.)*

3.3.207* Standard Deviation. A parameter that indicates the way in which a probability function is centered around its mean.

3.3.208 Standard Operating Guideline. An organizational directive that establishes a course of action or policy.

3.3.209 Standard Operating Procedure. A written organizational directive that establishes or prescribes specific operational or administrative methods to be followed routinely for the performance of designated operations or actions. [**1521,** 2020]

3.3.210* Strongback. The vertical members of a trench shoring system placed in contact with the earth, usually held in place against sections of sheeting with shores and positioned so that individual members do not contact each other.

3.3.211 Structural Marking System. A building marking system used to identify and display information related to structure identification, structure hazards evaluation, search assessment, and victim location.

3.3.212* Supplemental Sheeting and Shoring. Sheeting and shoring operations that involve the use of commercial sheeting/shoring systems and/or isolation devices or that involve cutting and placement of sheeting and shoring when greater than 2 ft (0.61 m) of shoring exists below the bottom of the strongback.

3.3.213 Support System. A structure, such as underpinning, bracing, or shoring, that provides support to an adjacent structure, underground installation, or the sides of an excavation.

3.3.214 Surcharge Load. Any weight near the lip of the trench that increases the likelihood of instability or secondary cave-in.

3.3.215 Swift Water. Water moving at a rate greater than one knot [1.15 mph (1.85 km/hr)].

3.3.216* System Safety Factor. The weakest point within a system, expressed as a ratio between the minimum breaking strength of that point (component) as compared to the force placed upon it.

3.3.217 System Stress. Any condition creating excessive force (i.e., exceeding the maximum working load of any component) to components within a rope rescue system that could lead to damage or failure of the system.

3.3.218* Tabulated Data. Any set of site-specific design data used by a professional engineer to design a protective system at a particular location.

3.3.219 Tagout. A method of tagging, labeling, or otherwise marking an isolation device during hazard abatement operations to prevent accidental removal of the device. *(See also 3.3.124, Lockout.)*

3.3.220 Technical Search and Rescue. The application of special knowledge, skills, and equipment to resolve unique and/or complex search and rescue situations.

3.3.221* Technical Search and Rescue Incident. Complex search and/or rescue incidents requiring specialized training of personnel and special equipment to complete the mission.

3.3.222* Technical Use. One designation of an equipment item or manufactured systems designed for technical-use loads, and escape based on design loads that are calculated and understood.

3.3.223 Tender. An individual trained in the responsibilities of diver safety who provides control of search patterns from the surface of the water.

3.3.224* Terrain. Specific natural and topographical features within an environment.

3.3.225* Terrain Hazard. Specific terrain feature, or feature-related condition, that exposes one to danger and the potential for injury and/or death.

3.3.226 Thorough Inspection. An in-depth inspection performed at intervals.

3.3.227 Throwline. See 3.3.186.5.1.

3.3.228* Traditional Sheeting and Shoring. The use of 4 ft × 8 ft (1.2 m × 2.4 m) sheet panels, with a strongback attachment, supplemented by a variety of conventional shoring options such as hydraulic, screw, and/or pneumatic shores.

3.3.229 Transfer Device. Various devices, including litters and harnesses, used with rope rescue systems to package and allow safe removal of a subject from a specific rescue environment.

3.3.230* Trench (or Trench Excavation). A narrow (in relation to its length) excavation made below the surface of the earth.

3.3.231 Trench Box (or Trench Shield). A manufactured protection system unit made from steel, fiberglass, or aluminum that is placed in a trench to protect workers from cave-in and that can be moved as a unit. *[See also 3.3.197, Shield (or Shield System).]*

3.3.232* Tunnel. A covered excavation used for the conveyance of people or materials, typically no smaller than 36 in. (0.91 m) in diameter and within 20 degrees of horizontal.

3.3.233* Universal Precautions. An approach to infection control in which human blood and certain human body fluids are treated as if known to be infectious for HIV, HBV, and other bloodborne pathogens.

3.3.234 Vehicle. A device or structure for transporting persons or things; a conveyance.

3.3.235 Victim Extrication Device. See 3.3.49.7.

3.3.236 Virgin Fiber. See 3.3.83.2.

3.3.237 Waist. The area above the hips and below the xiphoid process.

3.3.238 Watermanship Skills. Capabilities that include swimming, surface diving, treading water, and staying afloat with a reasonable degree of comfort appropriate to the required task.

3.3.239 Webbing. Woven material of flat or tubular weave in the form of a long strip.

3.3.239.1 ***Escape Webbing.*** Webbing dedicated solely for the purpose of supporting people during emergency self-escape (self-rescue); not intended for use in a hazardous environment involving fire or fire products.

3.3.239.2 ***Fire Escape Webbing.*** Webbing dedicated solely for the purpose of supporting people during emergency self-escape (self-rescue) from an immediately hazardous environment involving fire or fire products.

3.3.240* Wilderness. A setting in which the delivery of services including search, rescue, and patient care by response personnel is adversely affected by logistical complications, such as an environment that is physically stressful or hazardous to the patient, response personnel, or both; remoteness of the patient's location, such that it causes a delay in the delivery of care to the patient; anywhere the local infrastructure has been compromised enough to experience wilderness-type conditions, such as lack of adequate medical supplies, equipment, or transportation; remoteness from public infrastructure support services; poor to no medical services or potable water; compromised public safety buildings, public utilities or communications systems; city, county, state, provincial, tribal, or national recreational areas or parks with mountains, trails; areas they define as wilderness.

Chapter 4 General Requirements (NFPA 1670)

4.1 Administration.

4.1.1 Scope.

4.1.1.1* Chapters 4 through 23 shall identify and establish levels of functional capability for conducting operations at technical search and rescue incidents while minimizing threats to rescuers.

4.1.1.2* The requirements of Chapters 4 through 23 shall apply to organizations that provide response to technical search and rescue incidents, including those not regulated by governmental mandates.

4.1.1.3* It is not the intent of Chapters 4 through 23 to be applied to individuals and their associated skills and/or qualifications.

4.1.2* Purpose.

4.1.2.1 The purpose of Chapters 4 through 23 shall be to assist the AHJ in assessing a technical search and rescue hazard within the response area, to identify the level of operational capability, and to establish operational criteria.

4.1.2.2 The functional capabilities of Chapters 4 through 23 shall be permitted to be achieved in a variety of ways.

4.1.3 Equivalency. Nothing in this standard is intended to prevent the use of systems, methods, or devices of equivalent or superior quality, strength, fire resistance, effectiveness, durability, and safety over those prescribed by this standard.

4.1.3.1 Technical documentation shall be submitted to the AHJ to demonstrate equivalency.

4.1.3.2 The system, method, or device shall be approved for the intended purpose by the AHJ.

4.2 General.

4.2.1* The AHJ shall establish levels of operational capability needed to conduct operations at technical search and rescue incidents, based on hazard identification, risk assessment, training level of personnel, and availability of internal and external resources.

4.2.1.1* Organizations shall be capable of applying the requirements of any combination of technical rescue disciplines based on the need identified within their area of operations.

4.2.1.2* Organizations shall identify hazards, their likeliness and severity, so that capabilities can be established.

4.2.2 At a minimum, all technical search and rescue organizations shall meet the awareness level for each type of search and rescue incident for which the AHJ has identified a potential hazard *(see 4.3.1)*.

4.2.3* In jurisdictions where identified hazards might require a search and rescue capability at a level higher than awareness, a plan to address this situation shall be written.

4.2.3.1 The AHJ shall determine distribution of roles and responsibilities in order to focus training and resources at the designated level to maintain proficiency.

4.2.3.2 Where an advanced level of search and rescue capability is required in a given area, organizations shall have a system in place to utilize the most appropriate resource(s) available, through the use of local experts, agreements with specialized resources, and mutual aid.

4.2.4 The AHJ shall establish written standard operating procedures (SOPs) consistent with one of the following operational levels for each of the disciplines defined in this document:

(1)* *Awareness Level.* This level represents the minimum capability of organizations that provide response to technical search and rescue incidents.

(2)* *Operations Level.* This level represents the capability of organizations to respond to technical search and rescue incidents and to identify hazards, use equipment, and apply limited techniques specified in this standard to support and participate in technical search and rescue incidents.

(3) *Technician Level.* This level represents the capability of organizations to respond to technical search and rescue incidents and to identify hazards, use equipment, and apply advanced techniques specified in this standard necessary to coordinate, perform, and supervise technical search and rescue incidents.

4.2.5 It is not the intent of this document that an organization shall deem itself capable of an advanced skill level in any of the disciplines defined herein simply by training or adhering to the requirements set forth.

4.2.6* Maintaining an operations- or technician-level capability in any discipline shall require a combination of study, training, skill, and frequency of operations in that discipline.

4.2.7 The AHJ shall establish operational procedures consistent with the identified level of operational capability to ensure that technical search and rescue operations are performed in a manner that minimizes threats to rescuers and others.

4.2.8 The same techniques used in a search and rescue operation shall be considered equally useful for training, body recovery, evidence search, and other operations with a level of urgency commensurate with the risk/benefit analysis.

4.2.9 Operational procedures shall not exceed the identified level of capability established in 4.2.4.

4.2.10* At a minimum, medical care at the emergency medical technician (EMT) level of certification shall be provided by the organization at technical search and rescue incidents.

4.2.11 Training.

4.2.11.1 The AHJ shall provide for training in the responsibilities that are commensurate with the operational capability of the organization.

4.2.11.1.1 The minimum training for an organization shall be at the awareness level.

4.2.11.1.2 Organizations expected to perform at a higher operational level shall be trained to that level.

4.2.11.1.3* Any member of the organization who could be expected to perform at the awareness, operations, or technician level in a specific discipline shall be provided training to meet the job performance requirements for the identified performance level for that specific discipline as defined in NFPA 1006.

4.2.11.1.4 Each member of an organization operating at the awareness level shall be a competent person as defined in 3.3.34.

4.2.11.2* The AHJ shall provide for the continuing education necessary to maintain all requirements of the organization's identified level of capability.

4.2.11.3 An annual performance evaluation of the organization based on requirements of this standard shall be performed.

4.2.11.4* The AHJ shall evaluate its training program to determine whether the current training has prepared the organization to function at the established operational level under abnormal weather conditions, extremely hazardous operational conditions, and other difficult situations.

4.2.11.5* Documentation.

4.2.11.5.1 The AHJ shall be responsible for the documentation of all required training.

4.2.11.5.2 This documentation shall be maintained and available for inspection by individual team members and their authorized representatives.

4.2.12 Prior to operating at a technical search and rescue incident, an organization shall meet the requirements specified in Chapter 4 as well as all relevant requirements of Chapters 5 through 9 for the specific technical rescue incident.

4.2.13 Standard Operating Procedure.

4.2.13.1 The AHJ shall ensure that there is a standard operating procedure to evacuate members from an area and to account for their safety when an imminent hazard condition is discovered.

4.2.13.2 This procedure shall include a method to notify all members in the affected area immediately by any effective means, including audible warning devices, visual signals, and radio signals.

4.2.14* The AHJ shall comply with all applicable local, state, tribal, provincial, and federal laws.

4.2.15* The AHJ shall train responsible personnel in procedures for invoking, accessing, and using relevant components of the *National Search and Rescue Plan of the United States*, the "FEMA National Response Framework," and other national, state, and local response plans, as applicable.

4.3 Hazard Identification and Risk Assessment.

4.3.1* The AHJ shall conduct a hazard identification and risk assessment of the response area and shall determine the feasibility of conducting technical search and rescue operations.

4.3.2 The hazard identification and risk assessment shall include an evaluation of the environmental, physical, social, and cultural factors influencing the scope, frequency, and magnitude of a potential technical search and rescue incident and the impact they might have on the ability of the AHJ to respond to and to operate while minimizing threats to rescuers at those incidents.

4.3.3* The AHJ shall identify the type and availability of internal resources needed for technical search and rescue incidents and shall maintain a list of those resources.

4.3.4* The AHJ shall identify the type and availability of external resources needed to augment existing capabilities for technical search and rescue incidents and shall maintain a list of these resources, which shall be updated at least once a year.

4.3.5* The AHJ shall establish procedures for the acquisition of those external resources needed for technical search and rescue incidents.

4.3.6 The hazard identification and risk assessment shall be documented.

4.3.7 The hazard identification and risk assessment shall be reviewed and updated on a scheduled basis and as operational or organizational changes occur.

4.3.8 At intervals determined by the AHJ, the AHJ shall conduct surveys in the organization's response area for the purpose of identifying the types of technical search and rescue incidents that are most likely to occur.

4.4 Incident Response Planning.

4.4.1 The procedures for a technical search and rescue emergency response shall be documented in the special operations incident response plan.

4.4.1.1 The plan shall be a formal, written document.

4.4.1.2 Where external resources are required to achieve a desired level of operational capability, mutual aid agreements shall be developed with other organizations.

4.4.2 Copies of the technical search and rescue incident response plan shall be distributed to agencies, departments, and employees having responsibilities designated in the plan.

4.4.3 A record shall be kept of all holders of the technical search and rescue incident response plan, and a system shall be implemented for issuing all changes or revisions.

4.4.4 The technical search and rescue incident response plan shall be approved by the AHJ through a formal, documented approval process and shall be coordinated with participating agencies and organizations.

4.5 Equipment.

4.5.1 Operational Equipment.

4.5.1.1* The AHJ shall ensure that equipment commensurate with the respective operational capabilities for operations at technical search and rescue incidents and training exercises is provided.

4.5.1.2 Training shall be provided to ensure that all equipment is used and maintained in accordance with the manufacturers' instructions.

4.5.1.3 Procedures for the inventory and accountability of all equipment shall be developed and used.

4.5.2 Personal Protective Equipment (PPE).

4.5.2.1* The AHJ shall ensure that the protective clothing and equipment are supplied to provide protection from those hazards to which personnel are exposed or could be exposed.

4.5.2.2 Personnel shall be trained in the care, use, inspection, maintenance, and limitations of the protective clothing and equipment assigned or available for their use.

4.5.2.3 The AHJ shall ensure that all personnel wear and use PPE while working in known or suspected hazardous areas during technical search and rescue incidents and training exercises.

4.5.2.4 The AHJ shall ensure that atmosphere-supplying respirators in the form of supplied air respirators (SAR) or self-contained breathing apparatus (SCBA) are available when required for technical search and rescue operations and that they meet the requirements specified in Chapter 7 of NFPA 1500.

4.5.2.4.1 Breathing apparatus shall be worn in accordance with the manufacturer's recommendations.

4.5.2.4.2 A supply source of breathing air meeting the requirements of ANSI/CGA G7.1, *Commodity Specification for Air*, with a minimum air quality of Grade D shall be provided for all atmosphere-supplying respirators.

4.5.2.4.3 A supply source of breathing air meeting the requirements of ANSI/CGA G7.1, *Commodity Specification for Air*, with a minimum air quality of Grade E shall be provided for all atmosphere-supplying respirators used for dive operations.

4.5.2.4.4 Supplied air respirators shall be used in conjunction with a self-contained breathing air supply capable of providing enough air for egress in the event of a primary air supply failure.

4.6 Safety.

4.6.1 General.

4.6.1.1 All personnel shall receive training related to the hazards and risks associated with technical search and rescue operations.

4.6.1.2 All personnel shall receive training for conducting search and rescue operations while minimizing threats to rescuers and using PPE.

4.6.1.3 The AHJ shall ensure that members assigned duties and functions at technical search and rescue incidents and training exercises meet the relevant requirements of the following chapters and sections of NFPA 1500:

(1) Section 5.4, Special Operations Training
(2) Chapter 7, Protective Clothing and Protective Equipment
(3) Chapter 8, Emergency Operations

4.6.1.4* Where members are operating in positions or performing functions at an incident or training exercise that pose a high potential risk for injury, members qualified in BLS shall be standing by.

4.6.1.5* Rescuers shall not be armed except when it is required to meet the objectives of the incident as determined by the AHJ.

4.6.2 Safety Officer. At technical search and rescue training exercises and in actual operations, the incident commander shall assign a member to fulfill the duties of a safety officer with the specific technical knowledge and responsibility for the identification, evaluation, and, where possible, correction of hazardous conditions and unsafe practices specific to the operational capabilities employed.

4.6.3 Incident Management System (IMS).

4.6.3.1* The AHJ shall provide for and use training on the implementation of an IMS that meets the requirements of NFPA 1561 with written SOPs applying to all members involved in emergency operations.

4.6.3.2 All members involved in emergency operations shall be familiar with the IMS.

4.6.3.3 The AHJ shall provide for training on the implementation of an incident accountability system that meets the requirements of NFPA 1561.

4.6.3.4 The incident commander shall ensure rotation of personnel to reduce stress and fatigue.

4.6.3.5 The incident commander shall ensure that all personnel are aware of the potential impact of their operations on the safety and welfare of rescuers and others, as well as on other activities at the incident site.

4.6.3.6 At all technical search and rescue incidents, the organization shall provide supervisors who possess skills and knowledge commensurate with the operational level identified in 4.2.4.

4.6.4* Fitness. The AHJ shall ensure that members are psychologically, physically, and medically capable to perform assigned duties and functions at technical search and rescue incidents and to perform training exercises in accordance with Chapter 11 of NFPA 1500.

4.6.5 Nuclear, Biological, and Chemical Response.

4.6.5.1* The AHJ, as part of its hazard identification and risk assessment, shall determine the potential to respond to technical search and rescue incidents that might involve nuclear or biological weapons, chemical agents, or weapons of mass destruction, including those with the potential for secondary devices.

4.6.5.2 If the AHJ determines that a valid risk exists for technical search and rescue response into a nuclear, biological, and/or chemical environment, it shall provide training and equipment for response personnel.

Chapter 5 Rope Rescue (NFPA 1670)

5.1 General Requirements.

5.1.1 Organizations operating at rope rescue incidents shall meet the requirements specified in Chapter 4.

5.1.2* The AHJ shall evaluate the need for missing person search where rope rescues might occur within its response area and shall provide a search capability commensurate with the identified needs.

5.1.3* All techniques required of the rope rescue team within this standard shall be demonstrated by the team and/or team members on at least an annual basis to a level that assures their ability to perform the practice in a manner that will result in rapid access to and successful rescue of the victim while minimizing further injury and without sacrificing the safety of rescue team members.

5.2 Awareness Level.

5.2.1 Organizations operating at the awareness level for rope rescue incidents shall meet the requirements specified in Section 5.2.

5.2.2 Organizations operating at the awareness level for rope rescue incidents shall develop and implement procedures for the following:

(1) Initiating size-up to ascertain immediate response needs at a rope rescue incident
(2)* Identifying resources necessary to conduct rope rescue operations
(3)* Carrying out the emergency response system where rope rescue is required
(4)* Carrying out site control and scene management
(5)* Recognizing general hazards associated with rope rescue and the procedures necessary to mitigate these hazards
(6)* Identifying and using PPE assigned for use at a rope rescue incident
(7) Supporting an organization at the operations or technician level while functioning within an IMS

5.3 Operations Level.

5.3.1 Organizations operating at the operations level for rope rescue incidents shall meet the requirements specified in Sections 5.2 and 5.3.

5.3.2* Organizations operating at the operations level for rope rescue incidents shall, commensurate with the identified needs of the organization, develop and implement procedures for the use of ropes and rope rescue systems for the movement of persons from one stable location to another, including, but not limited to, the following:

(1) Conducting size-up of operations level rope rescue incidents
(2) Ensuring risk management techniques for rope rescue incidents are identified and complied with
(3)* Incorporating procedures or methods to ensure systems are constructed as prescribed and function as intended prior to use
(4) Establishing a method of command and communications so control of the rope rescue systems is established and maintained throughout the operation of rope rescue system
(5)* Identifying rope rescue techniques for use by the agency that facilitate the objective of moving a rescue load from one stable location to another in a low-angle environment
(6) Identifying rope rescue techniques for use by the agency that facilitate the objective of moving a rescue load from one stable location to another in a high-angle environment
(7) Selecting and identifying methods of constructing rope rescue mechanical advantage systems
(8) Selecting and identifying methods for lowering a load in a manner so that the speed of descent is controlled or can be stopped as desired
(9) Selecting and identifying methods for changing from a lowering or raising operation while the system is loaded
(10)* Identifying methods for selection and construction of anchors and anchor system(s) for rope rescue systems
(11) Identifying methods for the construction of fixed-line rope rescue systems
(12) Selecting, using, maintaining, and inspecting rope rescue equipment and hazard specific PPE according to the manufacturer's instructions and best practices
(13)* Providing redundancy in rope rescue systems in a manner that prevents an uncontrolled fall and limits the energy transmitted to the load and anchor system(s) in the event of a failure of any singular component within the system
(14) Implementing methods for the use of litters or other adjuncts identified by the AHJ for the movement of victims as part of a rope rescue system
(15) Selecting and identifying methods of connecting rescuers to the rope rescue system
(16)* Developing and implementing methods to provide for the retrieval of a rescuer who has become stranded while suspended from a rope rescue system
(17) Developing and implementing methods to prevent rescuers from falling while working on or near unprotected edges
(18) Developing and implementing methods for rescuers to negotiate an edge in a manner that minimizes dynamic forces and prevents equipment damage
(19)* Developing and implementing methods for negotiating a loaded litter over various types of edges, including those that must pass directly over an edge without the advantage of overhead anchors

5.4 Technician Level.

5.4.1 Organizations operating at the technician level for rope rescue incidents shall meet the requirements specified in Sections 5.2, 5.3, and 5.4.

5.4.2* Organizations operating at the technician level for rope rescue incidents shall develop and implement procedures, commensurate with the identified needs of the organization, for the following:

(1)* Accessing a patient using techniques that require rescuers to climb up or down natural or man-made structures, which can expose the climber to a significant fall hazard

(2)* Using rope rescue systems to move a rescuer and a patient along a horizontal path above an obstacle or projection
(3)* Performing a high-angle rope rescue of a person suspended from, or stranded on, a structure or landscape feature
(4) Applying the principles of the physics involved in constructing rope rescue systems, including system safety factors, critical angles, and the causes and effects of force multipliers
(5) Performing a high-angle rope rescue with a litter using tender(s) to negotiate obstacles, manipulate or position the patient, or provide medical care while being raised and lowered
(6) Performing rope rescue operations where the subject is in emotional or psychological crisis or distress

Chapter 6 Structural Collapse Search and Rescue (NFPA 1670)

6.1 General Requirements. Organizations operating at structural collapse incidents shall meet the requirements specified in Chapter 4.

6.2 Awareness Level.

6.2.1 Organizations operating at the awareness level for structural collapse incidents shall meet the requirements specified in Sections 6.2 and 7.2.

6.2.2 Organizations operating at the awareness level for structural collapse incidents shall implement procedures for the following:

(1) Initiating size-up to ascertain immediate response needs at a structural collapse search and rescue
(2)* Identifying the resources necessary to conduct structural collapse search and rescue operations
(3)* Initiating the emergency response system for structural collapse incidents
(4)* Initiating site control and scene management
(5)* Recognizing the general hazards associated with structural collapse incidents, including the recognition of applicable construction types and categories and the expected behaviors of components and materials in a structural collapse
(6)* Identifying all types of collapse patterns and potential victim locations
(7)* Recognizing the potential for secondary collapse
(8)* Conducting visual and verbal searches at structural collapse incidents, while using approved methods for the specific type of collapse
(9)* Recognizing and implementing a search and rescue/search assessment marking system, building marking system (structure/hazard evaluation), victim location marking system, and structure marking system (structure identification within a geographic area), such as the ones used by the "FEMA National Urban Search and Rescue (US&R) Response System"
(10) Removing readily accessible victims from structural collapse incidents
(11)* Identifying and establishing a collapse safety zone
(12)* Conducting reconnaissance (recon) of the structure(s) and surrounding area
(13) Supporting an organization at the operations or technician level while functioning within an IMS

6.3 Operations Level.

6.3.1 Organizations operating at the operations level for structural collapse incidents shall meet the requirements specified in Sections 5.3, 6.2, 6.3, 7.3, 8.3, 11.3, 12.3, and 16.2.

6.3.2 The organization shall have members capable of recognizing hazards, using equipment, and implementing techniques necessary to operate at structural collapse incidents involving the collapse or failure of ordinary construction (light frame, unreinforced masonry construction, and reinforced masonry construction).

6.3.3 Organizations operating at the operations level for structural collapse incidents involving light frame ordinary construction and reinforced and unreinforced masonry construction shall develop and implement procedures for the following:

(1)* Sizing up existing and potential conditions at structural collapse incidents
(2)* Recognizing unique collapse or failure hazards
(3)* Conducting hasty primary and secondary search operations (low and high coverage) intended to locate victims trapped on, inside, and beneath collapse debris
(4)* Accessing victims trapped inside and beneath collapse debris
(5)* Performing extrication operations involving packaging, treating, and removing victims trapped within and beneath collapse debris
(6)* Stabilizing the structure and performing rescue shoring operations using shores that include T shore, double T shore, two-post vertical shore, multiple-post vertical shore, door and window shore, horizontal shore, flying raker shore, split sole raker shore, solid sole raker shore, and box cribbing to make safe for rescue operations

6.4 Technician Level.

6.4.1 Organizations operating at the technician level for structural collapse incidents shall meet the requirements specified in Sections 5.4, 6.2, 6.3, 6.4, 7.4, 8.4, 11.4, and 12.4.

6.4.2 The organization shall have members capable of recognizing hazards, using equipment, and implementing techniques necessary to operate at structural collapse incidents involving all types of construction.

6.4.3 Organizations operating at the technician level for structural collapse incidents for all types of construction shall develop and implement procedures for the following:

(1) Evaluating existing and potential conditions at structural collapse incidents
(2) Recognizing unique collapse or failure hazards
(3)* Conducting search operations intended to locate victims trapped inside and beneath collapse debris
(4)* Accessing victims trapped inside and beneath collapse debris
(5)* Performing extrication operations involving packaging, treating, and removing victims trapped within and beneath collapse debris
(6)* Stabilizing the structure and performing rescue shoring operations using shores that include laced post shore, plywood laced post shore, sloped floor shores (Type 2 and Type 3), double raker shore, and flying shore to make safe for rescue operations

Chapter 7 Confined Space Search and Rescue (NFPA 1670)

7.1 General Requirements.

7.1.1 Organizations operating at confined space incidents shall meet the requirements specified in Chapter 4.

7.1.2* The requirements of this chapter shall apply to organizations that provide varying degrees of response to confined space emergencies.

7.1.3* The rescue service shall be capable of responding in a timely manner to rescue summons.

7.2 Awareness Level.

7.2.1 Organizations operating at the awareness level for confined space search and rescue incidents shall meet the requirements specified in Sections 5.2 and 7.2.

7.2.2 The organization shall have an appropriate number of personnel meeting the requirements of Chapter 4 of NFPA 470 commensurate with the organization's needs.

7.2.3 Organizations at the awareness level shall be responsible for performing certain nonentry rescue (retrieval) operations.

7.2.4 Organizations operating at the awareness level for confined space search and rescue incidents shall implement procedures for the following:

(1) Initiating size-up to ascertain immediate response needs at a confined space rescue incident
(2) Initiating contact and establishing communications with victims where possible
(3)* Recognizing and identifying the hazards associated with nonentry confined space emergencies
(4)* Recognizing confined spaces
(5)* Performing a nonentry retrieval
(6)* Implementing the emergency response system for confined space emergencies
(7)* Implementing site control and scene management
(8) Supporting an organization at the operations or technician level while functioning within an IMS

7.3 Operations Level.

7.3.1 Organizations operating at the operations level for confined space search and rescue incidents shall meet the requirements specified in Sections 5.3, 7.2, and 7.3.

7.3.2 The organization operating at this level shall be responsible for the development and training of a confined space rescue service that is trained, equipped, and available to respond to confined space emergencies of a type and complexity that require an operations-level organization.

7.3.2.1* The role of a confined space rescue service is intended to include entry into the space to perform a rescue and, as a minimum, shall be staffed to provide sufficient members with the following exclusive functions:

(1)* Rescue entrant/entry team of sufficient size and capability to perform the rescue
(2)* Backup rescue entrants of a sufficient number to provide immediate assistance to, or rescue of, rescue entrants who become ill or injured and are unable to perform self-rescue
(3) Rescue attendant whose function is to deny unauthorized persons access and to monitor the conditions in the space and the status of all entrants
(4) Rescue team leader (supervisor) whose function is to maintain control of the entire operation and be knowledgeable in all rescue service functions

7.3.2.2 Operations-level organizations shall be restricted to rescue inside confined spaces with the following characteristics:

(1)* Where the internal configuration of the space is clear and unobstructed so retrieval systems can be used for rescuer entrants without possibility of entanglement
(2)* Where the victim can be easily seen from the outside of the space's primary access opening
(3)* Where rescue entrants can pass easily through the access/egress opening(s) with room to spare when PPE is worn in the manner recommended by the manufacturer
(4)* Where the space can accommodate two or more rescue entrants in addition to the victim
(5)* Where all hazards in and around the confined space have been identified, isolated, and controlled

7.3.3 The operations-level organization shall ensure that each member of the rescue service meets the minimum requirements of operations-level confined space rescue in NFPA 1006.

7.3.4 If required to provide confined space rescue within regulated industrial facilities, the organization shall ensure the rescue service has access to all confined spaces from which rescue could be necessary so that they can develop rescue plans and practice rescue operations according to their designated level of competency.

7.3.5* The organization shall ensure that each member of the rescue service practices confined space rescues once every 12 months, in accordance with the requirements of 4.2.11 of this document, by means of simulated rescue operations in which he or she removes dummies, mannequins, or persons from actual confined spaces or from representative confined spaces resembling all those to which the rescue service could be required to respond in an emergency within their jurisdiction.

7.3.6 Representative confined spaces shall — with respect to opening size, configuration, and accessibility — simulate the types of confined spaces from which rescue is to be performed.

7.3.7 Organizations operating at the operations level shall develop and implement procedures for the following:

(1)* Sizing up existing and potential conditions at confined space emergencies
(2)* Protecting rescue personnel from hazards within and adjacent to the confined space
(3)* Ensuring that rescue personnel are capable of managing the physical and psychological challenges that affect rescuers entering confined spaces
(4)* Identifying the duties of the rescue entrant(s) and backup rescue entrant(s), rescue attendant, and rescue team leader as defined herein
(5)* Monitoring continuously, or at frequent intervals, the atmosphere in all parts of the space to be entered for oxygen content, flammability [lower explosive limit/lower flammable limit (LEL/LFL)], and toxicity, in that order
(6)* Performing entry-type rescues into confined spaces
(7)* Using victim packaging devices that could be employed in large, unobstructed confined spaces
(8)* Selecting, constructing, and using a rope-based lowering and -raising system in the high-angle environment

7.4 Technician Level.

7.4.1 Organizations operating at the technician level for confined space search and rescue emergencies shall meet the requirements of Sections 7.2, 7.3, and 7.4.

7.4.2 The organization operating at this level shall be responsible for the development of a confined space rescue service that is trained, equipped, and available to respond to emergencies within confined spaces of a type and complexity that requires a technician-level organization.

7.4.2.1 A technician-level rescue service shall be required for confined spaces with one or more of the following characteristics:

(1) Where the internal configuration of the space might create entanglement hazards and retrieval might not be effective
(2) Where the victim cannot be seen from the outside of the space's primary access opening
(3)* Where the portal size and configuration will not allow a rescuer to pass through the access/egress opening(s) using SCBA when worn in the manner recommended by the manufacturer
(4) Where all hazards in and around the confined space have been identified and can be mitigated by using respiratory protection

7.4.3 Organizations operating at the technician level for confined space search and rescue emergencies shall develop and implement procedures for the following:

(1) Developing hazard isolation and control requirements
(2)* Planning response for entry-type rescues in hazardous environments
(3)* Implementing the planned response
(4) Using victim packaging devices suitable for confined spaces with small entry portals and/or that are internally congested

Chapter 8 Vehicle Search and Rescue (NFPA 1670)

8.1* General Requirements. Organizations operating at vehicle search and rescue incidents shall meet the requirements specified in Chapter 4.

8.2 Awareness Level.

8.2.1 Organizations operating at the awareness level for vehicle emergencies shall meet the requirements specified in Section 8.2.

8.2.2 All members of the organization shall meet the requirements specified in Chapter 4 of NFPA 470 commensurate with the organization's needs.

8.2.3 Organizations operating at the awareness level for vehicle emergencies shall implement procedures for the following:

(1) Initiating size-up to ascertain immediate response needs at a vehicle search and rescue incident
(2)* Identifying the resources necessary to conduct operations
(3)* Initiating the emergency response system for vehicle search and rescue incidents
(4)* Initiating site control and scene management in accordance with NFPA 1091
(5)* Recognizing general hazards associated with vehicle search and rescue incidents
(6) Initiating traffic control and implementing a traffic incident management area (TIMA) as defined in NFPA 1091
(7) Establishing that individuals responsible for implementing the TIMA do so in accordance with NFPA 1091
(8) Supporting an organization at the operations or technician level while functioning within an IMS

8.3 Operations Level.

8.3.1 Organizations operating at the operations level for vehicle emergencies shall meet the requirements specified in Sections 8.2 and 8.3.

8.3.2 All members of the organization shall meet the requirements of Chapter 6 of NFPA 470 commensurate with the organization's needs.

8.3.3* The organization shall have members capable of recognizing hazards, using equipment, and implementing techniques necessary to operate safely and effectively at incidents involving persons injured or entrapped in a typical vehicle commonly found in the jurisdiction.

8.3.4 Organizations operating at the operations level for vehicle emergencies shall develop and implement procedures for the following:

(1)* Sizing up existing and potential conditions at vehicle search and rescue incidents
(2) Identifying probable victim locations and survivability
(3)* Making the search and rescue area safe, including identifying and controlling the hazards presented by the vehicle, its position, or its systems
(4)* Identifying, containing, and stopping fuel release
(5) Protecting a victim during extrication or disentanglement
(6) Packaging a victim prior to extrication or disentanglement
(7)* Accessing victims trapped in a typical vehicle commonly found in the jurisdiction
(8)* Performing extrication and disentanglement operations involving packaging, treating, and removing victims trapped in a common passenger vehicle, or other types of vehicles as identified by the AHJ as being commonly found in the jurisdiction, through the use of hand and power tools
(9)* Mitigating and managing general and specific hazards associated with vehicle search and rescue incidents that involve common passenger vehicles or other vehicles typically found in the jurisdiction
(10) Procuring and utilizing the resources necessary to conduct vehicle search and rescue operations
(11) Maintaining control of traffic at the scene of vehicle search and rescue incidents
(12) Stabilizing a vehicle that has come to rest on its tires on the road surface or similar flat and stable surface and managing the hazards related to vehicle movement resulting from extrication operations

8.3.5 Any member of the organization who could be expected to perform at the operations level for vehicle search and rescue shall be provided training to meet the job performance requirements for operations-level vehicle rescue as defined in NFPA 1006.

8.4 Technician Level.

8.4.1 Organizations operating at the technician level for vehicle emergencies shall meet the requirements specified in Chapter 8.

8.4.2 Organizations operating at the technician level for vehicle emergencies shall develop and implement procedures for the following:

(1) Evaluating existing and potential conditions at vehicle search and rescue incidents
(2)* Performing extrication and disentanglement operations involving packaging, treating, and removing victims injured or trapped in large commercial or industrial vehicles or any vehicles that present unique, complex, exotic, or unfamiliar hazards or extrication challenges
(3)* Using all specialized search and rescue equipment immediately available and in use by the organization
(4) Using specialized outside resources, including heavy equipment
(5) Stabilizing a vehicle that, because of its cargo, contents, position, location, or type, presents multiple concurrent hazards or requires advanced stabilization techniques prior to extrication operations or to protect against unwanted movement during extrication

8.4.3 Any member of the organization who could be expected to perform at the technician level for vehicle search and rescue shall be provided training to meet the job performance requirements for technician-level vehicle rescue in both common passenger vehicles and heavy vehicles as defined in NFPA 1006.

Chapter 9 Animal Technical Rescue (NFPA 1670)

9.1* General Requirements.

9.1.1 Organizations operating at animal rescue incidents shall meet the requirements specified in Chapter 4.

9.1.2 Each member of an organization operating at the awareness level shall be a competent person as defined in 3.3.34.

9.2 Awareness Level.

9.2.1 Organizations operating at the awareness level for animal rescue incidents shall meet the requirements specified in Section 9.2.

9.2.2 Organizations at the awareness level for animal rescues in situations covered within this document shall also meet the requirements of those specific chapters at the awareness level.

9.2.3 Organizations operating at the awareness level for animal rescue incidents shall develop and implement procedures for the following:

(1) Initiating size-up to ascertain immediate response needs at an animal rescue incident
(2) Identifying resources necessary to conduct animal rescue operations
(3) Carrying out the emergency response system where animal rescue operations are required
(4) Carrying out site control and scene management; to include mitigating hazards presented by animals and how to contain them in all phases of the incident; to include portable fencing, cages, traps, or other equipment as available
(5) Recognizing general hazards associated with animal rescue operations and the procedures necessary to mitigate these hazards
(6) Identifying and using PPE assigned for use at an animal rescue incident
(7) Requesting the appropriate assistance to determine if a technical rescue vs. recovery will be conducted
(8) Recognizing and identifying the special equipment and personnel used in animal rescue incidents
(9) Understanding the social, political, and public safety issues related to effective animal rescue services
(10) Recognizing hazmat considerations involving animal rescue and requesting resources to deal with those issues
(11) Supporting an organization at the operations or technician level while functioning within an IMS

9.3 Operations Level.

9.3.1 Organizations performing animal rescue at the operations level shall meet all requirements of Sections 5.3, 9.2, and 9.3.

9.3.2 Organizations performing animal rescue for animals not readily accessible shall meet all requirements of Sections 5.3, 9.2, and 9.3.

9.3.3 Organizations at the operations level performing animal rescue in situations covered within this document shall also meet the requirements of those specific chapters at the operations level.

9.3.4 Organizations operating at the operations level for animal rescue incidents shall, commensurate with the identified needs of the organization, develop and implement procedures for the following:

(1) Identifying hazards to rescuers posed by the animal (perform risk assessment)
(2) Identifying behavioral body posture cues to determine the disposition of the animal
(3) Creating an improvised restraint device to establish physical restraint/control of an animal, both ambulatory and nonambulatory
(4) Identifying appropriate attachment points to the animal and appropriate positioning of the animal for extrication with minimal injury to the animal and responders
(5) Using a harness, halter, leash, webbing, sack, or cage, whether improvised, custom, or commercially manufactured, to assist in the movement of an ambulatory animal from one stable location to another in a low-angle environment
(6) Using an animal packaging device or system to move a recumbent animal from one stable location to another in a low-angle environment
(7) Performing a low-angle and high-angle lower and raise of an animal using an improvised, custom, or commercially manufactured system, to include safely accessing, managing, and packaging the patient
(8) Recognizing when chemical restraint is needed or contraindicated and requesting if needed
(9) In rescues from soil or other adhesive material environments, recognizing the need to alleviate suction on an animal's limbs
(10) Using behavioral cues and “fight or flight” or “tipping point” behavior characteristics to assist in a rescue

(11) Using containment techniques for animals that cannot be immediately handled or which require greater control and attention to behavior
(12) Using auxiliary equipment to facilitate the safe placement of rescue devices on the animal
(13) Constructing and operating a portable high-point anchor system
(14) Mitigating the hazards to animals and responders in trailer extrication

9.4 Technician Level.

9.4.1 Organizations performing animal rescue at the technician level shall meet all requirements of Sections 5.4, 9.2, 9.3, and 9.4.

9.4.2 Organizations performing animal rescue at the technician level for animals not readily accessible shall meet all requirements of Sections 5.4, 9.2, 9.3, and 9.4.

9.4.3 Organizations at the technician level performing animal rescue in situations covered within this document shall also meet the requirements of those specific chapters at the level appropriate for the situation.

9.4.4 Organizations at the technician level performing animal rescue of animals that have broken through ice on frozen bodies of water shall develop and implement procedures for cutting a path through ice and providing water rescue or performing a sideways drag with edge protection or cantilevering of the animal to safety.

9.4.5 Organizations operating at the technician level for animal rescue incidents shall develop and implement procedures, commensurate with the identified needs of the organization, for the following:

(1) Using a tested harness device designed for animals and extended use in the high-angle environment
(2) Performing a high-angle rescue of an animal stranded on a structure or landscape feature
(3)* Negotiating an obstacle or projection along a horizontal path with an animal packaged in a litter or sling system
(4) Applying the principles of the physics involved in constructing rope rescue systems, including system safety factors, critical angles, and the causes and effects of force multipliers
(5)* Using high-angle rescue techniques to negotiate obstacles or otherwise manipulate the position of an animal packaged in an animal litter or sling system
(6) Moving an animal packaged in a litter or sling system up and over an edge during a raising or vertical lift operation with a rope system
(7) Mitigating dynamic loads associated with animal behaviors in a rope rescue system

Chapter 10 Wilderness Search and Rescue (NFPA 1670)

10.1 General Requirements.

10.1.1 Organizations operating at wilderness search and rescue incidents shall meet the requirements specified in Chapter 4.

10.1.2* The AHJ, as part of its hazard identification and risk assessment *(see 4.3.2)*, shall identify all locations and situations in the jurisdiction that meet the definition of *wilderness*.

10.2 Awareness Level.

10.2.1 Organizations operating at the awareness level at wilderness search and rescue incidents shall meet the requirements specified in Section 10.2.

10.2.2 Members of organizations at the awareness level shall be permitted to assist in support functions on a wilderness search and rescue operation but shall not be deployed into the wilderness.

10.2.3 Organizations operating at the awareness level at any wilderness search and rescue incident shall have the following capabilities:

(1) Initiating size-up to ascertain the need for wilderness search and rescue response, the number of subjects, and their reported location
(2)* Initiating the emergency response system for wilderness search and rescue
(3)* Initiating site control and scene management
(4)* Recognizing the general hazards associated with wilderness search and rescue incidents
(5) Recognizing the environment and type of terrain involved in wilderness search and rescue incidents
(6)* Recognizing the limitations of conventional emergency response skills and equipment in various wilderness environments
(7)* Initiating the collection and recording of information necessary to assist operational personnel in a wilderness search and rescue
(8)* Identifying and isolating any reporting parties and witnesses
(9) Supporting an organization at the operations or technician level while functioning within an IMS

10.3 Operations Level.

10.3.1 Organizations operating at the operations level at wilderness search and rescue incidents shall meet the requirements specified in Sections 5.3, 10.2, and 10.3.

10.3.2* The AHJ shall establish standard operating procedures (SOPs) that identify the specific environments in which operations-level organizations are permitted to operate.

10.3.3 Organizations operating at the operations level at wilderness search and rescue incidents shall be trained and equipped to operate in the following environments:

(1) Where the general location of the subject is known
(2) Where travel is limited to walking along trails or uneven or off-trail terrain
(3) Where water obstacles, if present, are no more than 2 ft (0.61 m) deep
(4) Where terrain is negotiable without undue exposure
(5) Where terrain is walkable and can be negotiated without scrambling or climbing
(6) Where the incident spans one operational period of 8 hours or less
(7) Where routes are obvious, and specialized map skills are not required
(8) Where travel might involve low-angle travel or patient evacuation on slopes where a rope system could be used for safety but not for suspension
(9) Where weather conditions are stable and do not pose a hazard for rescuers or subject

(10) Where environmental conditions, such as altitude, snow and scree slopes, exposure, and other terrain factors do not pose a hazard to rescuers or subjects

10.3.4 Organizations operating at the operations level at wilderness search and rescue incidents shall be capable of the following:

(1)* Sizing up existing and potential conditions at incidents where wilderness search and rescue will be performed
(2)* Requesting and interfacing with wilderness search and rescue resources
(3) Providing the specialized medical care and protocols that are unique to the wilderness environment
(4)* Using personal survival, body management, and preparedness skills for the specific wilderness environments in which the rescuer could become involved
(5) Operating for an 8-hour period without support
(6) Recognizing the need for, and procedures and equipment for the provision of, environmental protection through clothing systems applicable to the specific wilderness environments in which the rescuer could become involved
(7)* Selecting, caring for, and using personal medical and support equipment and packing it with due regard to how it will be carried
(8) Conducting an interview of a reporting party; documenting and transmitting pertinent information
(9) Recognizing and preserving evidence at a point last seen (PLS) or a last known point (LKP)
(10) Locating a subject in the operational environment based on reporting party information when the general location of the subject is known
(11)* Traveling through various wilderness environments in which the rescuer could become involved while minimizing threats to safety
(12)* Using land navigation techniques on well-marked terrain that include map and compass as well as any methods of navigation and position reporting used by the responding organizations with which the organization could become involved
(13) Procuring the necessary maps and navigational and topographical information
(14) Modifying actions and urgency as applicable to a rescue versus a recovery
(15) Acquiring information on current and forecast environmental factors, including weather, temperature, precipitation, winds, avalanche risk, and tide levels
(16)* Participating in and supporting wilderness search operations intended to locate victims whose exact location is unknown
(17) Accessing, packaging, and caring for a patient in the operational environment
(18) Recognizing, identifying, and utilizing the rescue hardware and software used by the responding organizations with which the organization could become involved
(19) Working in and around any aircraft, watercraft, and special vehicles used for SAR operations while minimizing threats to rescuers
(20) Integrating specialized transport into the operational environment
(21)* Recognizing the organization's limitations regarding accessing and/or evacuating a victim
(22) Recognizing when the incident requires a technician-level response or when other specialized resources are required

10.4 Technician Level.

10.4.1 Organizations operating at the technician level at wilderness search and rescue incidents shall meet the requirements specified in Sections 5.4, 10.2, 10.3, 10.4, 15.2, and 16.2.

10.4.2* Each member of the wilderness search and rescue organization at the technician level shall be trained to, as a minimum, a Mountain Rescue Association team member or the equivalent.

10.4.3 Organizations operating at the technician level shall be capable of performing and supervising all aspects of wilderness search and rescue operations with which the organization could become involved.

10.4.4* Wilderness search and rescue organizations at the technician level shall not be required to develop and maintain capabilities in all types of wilderness search and rescue operations.

10.4.5 The ability of the organization to respond at the technician level in one type of wilderness search and rescue operation shall not imply the ability to respond at the technician level in all types of wilderness search and rescue operations.

10.4.6 Organizations operating at the technician level at wilderness search and rescue incidents shall be capable of operating in the following environments in which special search and rescue training and equipment are required or where the capabilities of operations-level equipment and training are exceeded:

(1) Where the general location of the subject might or might not be known
(2) Where an extensive search and rescue capabilities are required
(3) That might involve terrain that requires difficult scrambling or climbing
(4) That might involve water deeper that 2 ft (0.61 m)
(5) That might involve terrain that is difficult if exposed or dangerous and requires special skills for travel
(6) That might involve terrain that requires technical rock- or snow-climbing skills and equipment or other rope access techniques
(7) Where the incident might span more than one operational period of 8 hours
(8) Where locating routes requires the use of navigational technology
(9) That might involve travel or patient evacuation on steep to vertical slopes where rope systems are essential for security or suspension
(10) That might involve weather conditions that require specialized clothing, travel methods, and equipment
(11) Where environmental conditions, such as altitude, snow or scree slopes, exposure, and other terrain factors require specialized clothing, travel methods, and equipment

10.4.7 Organizations operating at the technician level at wilderness search and rescue incidents shall develop and implement procedures for the following:

(1) Evaluating existing and potential conditions at incidents where wilderness search and rescue will be performed and determining the need for technician-level teams
(2) Acquiring, using, and coordinating technician-level wilderness search and rescue resources

(3) Providing input to standard operating procedures for anticipated wilderness responses
(4)* Initiating and, where qualified, coordinating and performing technician-level wilderness search and rescue operations
(5)* Writing and using an operational plan for search and rescue in the extreme environment

10.4.8* The AHJ shall base the specialized training and equipment that is required for its jurisdiction on the following factors:

(1) Temperature
(2) Weather
(3) Terrain
(4) Flora and fauna
(5) Altitude
(6) Travel time
(7) Patient care issues
(8) Duration of incident
(9) Logistics
(10) Communications
(11) Navigation
(12) Management needs

10.4.9 Organizations operating at the technician level at wilderness search and rescue incidents shall be capable of the following:

(1) Conducting an interview of a reporting party; documenting and transmitting pertinent information
(2) Recognizing and preserving evidence at a point last seen (PLS) or a last known point (LKP)
(3) Operating for a 24-hour period without support
(4) Navigating with specialized navigation equipment
(5) Locating a subject in the operational environment based on reporting party information when the general location of the subject might or might not be known
(6) Packaging, transporting, and caring for a patient in the operational environment
(7) Determining when other specialized resources are required
(8) Knowing the specialized resources available to the jurisdiction

Chapter 11 Trench Search and Rescue (NFPA 1670)

11.1 General Requirements. Organizations operating at trench and excavation search and rescue incidents shall meet the requirements specified in Chapter 4.

11.2 Awareness Level.

11.2.1 Organizations operating at the awareness level at trench and excavation emergencies shall meet the requirements specified in Sections 7.2 and 11.2.

11.2.2 Each member of the organization shall meet the requirements specified in Chapter 4 of NFPA 470 and shall be a competent person as defined in 3.3.34.

11.2.3 Organizations operating at the awareness level at trench and excavation emergencies shall implement procedures for the following:

(1) Initiating size-up to ascertain immediate response needs for a trench rescue
(2) Recognizing the need for technical resources
(3)* Identifying the resources necessary to conduct safe and effective trench and excavation emergency operations
(4)* Initiating the emergency response system for trenches and excavations
(5)* Initiating site control and scene management
(6)* Recognizing general hazards associated with trench and excavation emergency incidents and the procedures necessary to mitigate these hazards within the general rescue area
(7)* Recognizing typical trench and excavation collapse patterns, the reasons trenches and excavations collapse, and the potential for secondary collapse
(8)* Initiating a rapid, nonentry extrication of noninjured or minimally injured victim(s)
(9)* Recognizing the unique hazards associated with the weight of soil and its associated entrapping characteristics
(10) Implementing a hazard identification and isolation plan, including securing hazardous equipment, contacting utility location services, establishing control of affected utilities, and using methods for protecting bystanders and rescuers from accidentally falling into the excavation or increasing the likelihood of additional collapse
(11)* Identifying and implementing methods for approaching and working around the excavation in a manner that minimizes the potential of collapse resulting from additional imposed loads on the lip of the trench
(12) Supporting an organization at the operations or technician level while functioning within an IMS

11.3 Operations Level.

11.3.1 Organizations operating at the operations level at trench and excavation emergencies shall meet the requirements specified in Sections 11.2 and 11.3.

11.3.2 Each member of the organization shall meet the requirements specified in Chapter 4 of NFPA 470.

11.3.3* Members shall be capable of recognizing the hazards of using equipment and operating at trench and excavation emergencies that include the collapse or failure of individual, nonintersecting trenches with an initial depth of 8 ft (2.4 m) or less under the following conditions:

(1) No severe environmental conditions exist.
(2) Digging operations do not involve supplemental sheeting and shoring.
(3) Only traditional sheeting and shoring are used.

11.3.4 Organizations operating at the operations level at trench and excavation emergencies shall develop and implement procedures for the following:

(1)* Sizing up existing and potential conditions at trench and excavation emergencies
(2) Identifying potential hazards to victims and rescuers
(3) Implementing a hazard control plan
(4) Initiating entry into a trench or excavation rescue area
(5)* Recognizing unstable areas associated with trench and excavation emergencies and adjacent structures
(6)* Identifying probable victim locations and survivability
(7)* Initiating a one-call utility location service
(8)* Identifying soil types using accepted visual or manual tests
(9) Ventilating the trench or excavation space
(10) Identifying and recognizing a bell-bottom pier hole excavation and its associated unique hazards

(11)* Minimizing the effect the impact of rescuers and related equipment have on the forces in the soil around the trench and the increased potential they might pose for additional collapse
(12)* Providing entry and egress paths for entry personnel
(13)* Implementing a shoring plan for a straight, nonintersecting trench no more than 8 ft (2.4 m) in depth to protect the rescue area from additional collapse using conventional sheet and panel shoring systems whose capacities and methods of assembly are based on tabulated data or other applicable engineered system documentation
(14)* Conducting a pre-entry briefing
(15)* Initiating record keeping and documentation during entry operations
(16) Selecting, using, and applying shield systems
(17)* Selecting, using, and applying sloping and benching systems
(18) Identifying the duties of panel teams, entry teams, and shoring teams
(19) Assessing the mechanism of entrapment and the method of victim removal
(20)* Performing extrication
(21) Dismantling support systems
(22) Monitoring continuously or at frequent intervals all areas of the trench to be entered for oxygen content, flammability, and toxicity, in that order

11.4 Technician Level.

11.4.1 Organizations operating at the technician level at trench and excavation emergencies shall meet the requirements specified in Sections 7.4 and 11.4.

11.4.2* Members shall be capable of recognizing hazards, using equipment, and operating at trench and excavation emergencies that include the collapse or failure of individual or intersecting trenches with an initial depth of more than 8 ft (2.4 m) or where severe environmental conditions exist, digging operations involve supplemental sheeting and shoring, or manufactured trench boxes or isolation devices would be used.

11.4.3 Organizations operating at the technician level at trench and excavation emergencies shall develop and implement procedures for the following:

(1) Evaluating existing and potential conditions at trench and excavation emergencies
(2) Developing and implementing a shoring plan for intersecting trenches
(3)* Implementing alternative shoring or support methods, including the use of single point shores, backfilling, and load transfer elements such as walers, for supporting irregular soil contours or other areas of the trench, where conventional sheeting and panel shoring cannot be properly installed to provide the adequate soil contact needed to minimize or prevent soil movement
(4) Supporting an intersecting trench as part of a team
(5) Installing supplemental sheeting or shoring for every 2 ft (0.609 m) of depth below existing established shoring
(6) Constructing a load stabilization system
(7) Lifting a stabilized load
(8) Coordinating the use heavy equipment
(9)* Identifying, constructing, and removing manufactured protective systems consistent with the application and limitations of such systems using tabulated data and approved engineering practices
(10)* Monitoring continuously or at frequent intervals the atmosphere in all parts of the trench to be entered for oxygen content, flammability (LEL/LFL), and toxicity, in that order
(11) Identifying the construction, application, limitations, and removal of supplemental sheeting and shoring systems designed to create approved protective systems
(12) Adjusting the protective systems based on digging operations and environmental conditions
(13)* Rigging and placement of isolation systems
(14) Releasing and extricating the victim
(15) Dismantling support systems
(16)* Applying engineering principles to aid in identifying incompatible soil conditions or where alternative shoring methods might pose increased risk of collapse due to increased loads imposed on individual structural elements

Chapter 12 Machinery Search and Rescue (NFPA 1670)

12.1 General Requirements. Organizations operating at machinery search and rescue incidents shall meet the requirements specified in Chapter 4.

12.2 Awareness Level.

12.2.1 Organizations operating at the awareness level for machinery emergencies shall meet the requirements specified in Section 12.2.

12.2.2 All members of the organization shall meet the requirements specified in Chapter 4 of NFPA 470 commensurate with the organization's needs.

12.2.3 Organizations operating at the awareness level for machinery emergencies shall implement procedures for the following:

(1)* Initiating size-up to ascertain immediate response needs at a machinery rescue incident
(2)* Recognizing the need for a machinery search and rescue
(3)* Identifying the resources necessary to conduct operations
(4)* Initiating the emergency response system for machinery search and rescue incidents
(5)* Initiating site control and scene management
(6)* Recognizing general hazards associated with machinery search and rescue incidents
(7)* Supporting an operations- or technician-level machinery rescue incident while functioning within an IMS

12.3 Operations Level.

12.3.1 Organizations operating at the operations level for machinery emergencies shall meet the requirements specified in Sections 12.2 and 12.3.

12.3.2 All members of the organization shall meet the requirements of Chapter 6 of NFPA 470 commensurate with the organization's needs.

12.3.3 The organization shall have members capable of recognizing hazards, using equipment, and implementing techniques necessary to operate safely and effectively at incidents involving persons injured or entrapped in a small machine. (*Refer to the definition for small machine in NFPA 1006.*)

12.3.4 Organizations operating at the operations level for machinery emergencies shall develop and implement procedures for the following:

(1)* Sizing up and planning for existing and potential conditions at machinery search and rescue incidents
(2) Identifying probable victim locations and survivability
(3)* Making the search and rescue area safe, including the stabilization and isolation of all machinery involved
(4)* Identifying and controlling the hazards presented by the release of fluids as gases associated with the machinery, which include, but are not limited to, fuel, cutting or lubricating oil, and cooling water
(5) Protecting a victim during extrication or disentanglement
(6) Packaging a victim prior to extrication or disentanglement
(7) Accessing victims trapped in machinery via access and egress points
(8)* Performing extrication and disentanglement operations involving packaging, treating, and removing victims trapped in machinery where the entrapment is limited to digits or where the machine can be simply disassembled, or is constructed of lightweight materials that can be cut, spread, or lifted and has only simple hazards that are readily controlled
(9)* Mitigating and managing general and specific hazards associated with machinery search and rescue incidents, to include fire protection
(10) Procuring and using the resources, to include subject matter experts, necessary to conduct machinery search and rescue operations
(11)* Identifying potential emergency events in buildings where mechanical equipment exists, such as elevators, and developing preplans
(12)* Terminating a machinery rescue emergency
(13) Supporting a technician-level machinery rescue incident while functioning within an IMS

12.3.5 Rescue members shall make provisions for fall prevention or protection for both rescuers and subjects when working in areas where potential falls can occur.

12.4 Technician Level.

12.4.1 Organizations operating at the technician level for machinery emergencies shall meet the requirements specified in Sections 12.2, 12.3, and 12.4.

12.4.2 All members of the organization shall meet the requirements of Chapter 6 of NFPA 470 commensurate with the organization's needs.

12.4.3* The organization shall have members capable of recognizing hazards, using equipment, and implementing techniques necessary to operate safely and effectively at incidents involving persons injured or entrapped in a large machine.

12.4.4 Organizations operating at the technician level for machinery emergencies shall develop and implement procedures for the following:

(1) Evaluating existing and planning potential conditions at machinery search and rescue incidents, within IMS
(2)* Performing extrication and disentanglement operations from large machines
(3)* Stabilizing large machines and their components at machinery search and rescue incidents
(4)* Using all specialized search and rescue equipment immediately available and in use by the organization
(5)* Removing the occupants of a stranded elevator by way of the car doors when the floor of the elevator is more than 3 ft (914.4 mm) from any floor served, the top hatch, or a service door or when occupants or rescuers are otherwise exposed to the hazards of the inside of the shaft or the machinery to propel the elevator
(6) Determine existing or creating new egress and access openings for large machinery

12.4.5* In elevator rescue, when there are other elevators operating in a common hoistway, all adjacent elevator(s) shall be cleared of passenger(s) and positioned alongside of the stalled elevator.

12.4.6* Adjacent elevators that share a common hoistway shall be secured and prevented from unintentional movement whenever rescuers or victims are exposed to the movement of cars or counterweights in the shaft.

Chapter 13 Cave Search and Rescue (NFPA 1670)

13.1 General Requirements.

13.1.1 Organizations operating at cave search and rescue incidents shall meet the requirements specified in Chapter 4.

13.1.2 The AHJ, as part of its hazard identification and risk assessment *(see 4.3.2)*, shall identify locations and situations in the jurisdiction that meet the definition of *cave*.

13.2 Awareness Level.

13.2.1 Organizations operating at the awareness level at cave search and rescue incidents shall meet the requirements specified in Section 13.2.

13.2.2 Members of organizations at the awareness level shall be permitted to assist in support functions on a cave search and rescue operation but shall not be deployed into the cave.

13.2.3 Organizations operating at the awareness level at any cave incident shall implement procedures for the following:

(1) Initiating size-up to ascertain the need for a cave search and rescue, the number of subjects, and their reported locations
(2)* Recognizing the limitations of conventional emergency response skills and equipment in various cave environments
(3)* Initiating the emergency response system for cave search and rescue
(4) Initiating site control and scene management
(5)* Recognizing the general hazards associated with cave search and rescue incidents
(6)* Establishing control of all cave entrances
(7)* Initiating the collection and recording of information necessary to assist operational personnel in a cave search and rescue
(8)* Identifying and isolating any reporting parties and witnesses
(9) Supporting an organization at the operations or technician level while functioning within an IMS

13.3 Operations Level.

13.3.1 Organizations operating at the operations level at cave search and rescue incidents shall meet the requirements specified in Sections 5.3, 13.2, and 13.3.

13.3.2 Organizations operating at the operations level in cave search and rescue shall be under the supervision of organizations at the technician level when operating in a cave environment where technician-level skills are required.

13.3.2.1* Organizations operating at the operations level at cave search and rescue incidents shall be trained and equipped to operate in situations where all of the following conditions are true:

(1) Where the general location of the subject is known
(2) Where movement through the passage is not more difficult than walking or crawling or moving over uneven surfaces
(3) Where water obstacles, if present, are no more than 2 ft (0.61 m) deep
(4) Where cave passage is easily negotiable without undue exposure
(5) Where cave passage is open and can be negotiated without squeezing through tight or constricted spaces
(6) Where travel or transport does not involve fragile cave environments
(7) Where the incident spans an operational period of no more than 8 hours
(8) Where routes are obvious, and specialized map skills are not required
(9) Where travel might involve low-angle travel or patient evacuation on slopes where rope can be used for safety but not for suspension

13.3.2.2 Outside of the specific environments identified above and/or by the AHJ, personnel from technician-level cave search and rescue organizations or special cave search and rescue resources shall be utilized when operating in a cave environment.

13.3.3 Organizations operating at the operations level at cave search and rescue incidents shall develop and implement procedures for the following:

(1)* Sizing up existing and potential conditions at incidents where cave search and rescue will be performed
(2)* Requesting and interfacing with cave search and rescue resources
(3)* Recognizing the types of cave passages and the vertical and horizontal extent of those passages as well as restrictions and water hazards involved in cave search and rescue incidents
(4)* Providing the specialized medical care and protocols that are unique to the cave environment
(5) Recognizing the need for, and procedures and equipment for the provision of, environmental protection through clothing systems applicable to the specific cave environments in which the organization could become involved
(6)* Selecting, caring for, and using personal, medical, and support equipment and packing it with due regard to how it will be carried and for protection from the cave environment
(7)* Traveling expeditiously through various cave environments in which the organization could become involved, while minimizing threats to safety
(8) Using appropriate cave navigation techniques, including map and compass, trail markers, balls of string, as well as any methods of navigation and position reporting
(9) Ensuring that personnel are capable of safely and effectively operating for an 8-hour period without support
(10) Procuring the necessary cave maps and navigational and topographical information
(11) Modifying actions and urgency as applicable to a rescue versus a recovery
(12) Acquiring information on current and forecast weather, including temperature, precipitation, and winds
(13)* Mitigating dangers from weather outside the cave on the rescue operation within the cave
(14)* Participating in and supporting cave search operations intended to locate victims whose exact location is unknown
(15) Accessing, packaging, and evacuating individuals from all cave environments and terrain where operations-level capabilities are appropriate
(16) Recognizing, identifying, and utilizing all rescue hardware and software used by the responding organizations with which the organization could become involved
(17)* Recognizing the team's limitations regarding accessing and/or evacuating a victim
(18) Establishing procedures for conducting an interview of a reporting party and for documenting and transmitting pertinent information
(19) Establishing procedures for recognizing and preserving evidence and a point last seen (PLS) or a last known point (LKP)
(20) Locating a subject in the operational environment based on reporting party information when the general location of the subject is known
(21)* Deploying and operating in-cave wired and wireless communications systems that allow direct communication from in-cave rescue operations personnel to incident command
(22) Establishing an accountability system for all persons and equipment entering or leaving any and all of the cave's entrances
(23) Recognizing and understanding the unique characteristics of search segmentation using a two-dimensional map for a three-dimensional cave
(24) Understanding when the incident requires a technician-level response or when other specialized resources are required

13.4 Technician Level.

13.4.1 Organizations operating at the technician level at cave search and rescue incidents shall meet the requirements specified in Sections 5.4, 10.3, 13.2, 13.3, 13.4, and 16.2

13.4.2 Organizations operating at the technician level at cave search and rescue incidents shall be capable of operating in environments in which special cave search and rescue training and equipment are required or where the capabilities of operations-level equipment and training are exceeded.

13.4.3 Technician-level response capability shall be required where any of the following are true:

(1) Where cave passage involves difficult scrambling or climbing
(2) Where water obstacles deeper than 2 ft (0.61 m) are present

(3) Where search and/or rescue involves technical cave passage that is difficult to negotiate without special skills or that might be exposed or dangerous
(4) Where cave passage is tight and might require squeezing through constricted spaces
(5) Where travel or transport might involve fragile cave environments
(6) Where the incident might span more than one operational period of 8 hours
(7) Where specialized route-finding skills are required, or the use of cave maps is required
(8) Where travel or patient evacuation requires negotiating steep to vertical slopes where rope is essential for security or suspension

13.4.4 Organizations operating at the technician level shall be capable of performing and supervising all aspects of cave search and rescue operations with which the organization could become involved.

13.4.5* The ability of the organization to respond at the technician level in one type of cave search and rescue operation shall not imply the ability to respond at the technician level in all types of cave search and rescue operations.

13.4.6 Organizations operating at the technician level at cave search and rescue incidents shall develop and implement procedures for the following:

(1) Evaluating existing and potential conditions at incidents where cave search and rescue will be performed
(2) Acquiring, utilizing, and coordinating search and rescue resources with which the organization could become involved
(3) Providing input to standard operating procedures for anticipated cave responses
(4)* Initiating and performing all aspects of search and rescue operations in the cave
(5)* Writing and utilizing an operational plan for cave search and rescue

Chapter 14 Mine and Tunnel Search and Rescue (NFPA 1670)

14.1 General Requirements.

14.1.1 Organizations operating at mine and tunnel incidents shall meet the requirements specified in Chapter 4.

14.1.2* The requirements of this chapter shall apply to agencies that provide varying degrees of response to tunnels or other underground excavations previously classified as mines or tunnels.

14.1.2.1 The requirements of this chapter shall not apply to operating mines.

14.1.2.2* The requirements of Chapter 7 shall not apply to the basic underground structures and excavations addressed in this chapter but shall be relevant to equipment or spaces found inside the structure or excavation.

14.1.3* All mine and tunnel rescue services shall meet the requirements in 14.1.3.1 through 14.1.4.

14.1.3.1 Each member of the search and rescue organization shall be provided with, and be trained to properly use, the personal protective and rescue equipment necessary for making rescues from mines and tunnels according to his or her assignment and designated level of competency.

14.1.3.2* Each member of the search and rescue organization shall be equipped, trained, and capable of performing the assigned search and rescue duties corresponding to the member's assignment and designated level of competency.

14.1.3.3 Emergency services that are the designated primary provider of rescue services for operational mines and tunnels under construction shall comply with applicable regulations.

14.1.3.4* As part of a team, each member shall practice making mine or tunnel rescues consistent with their designated level of competency, in accordance with the requirements of 4.2.11, by means of simulated rescue operations in which dummies, mannequins, or persons are removed from actual mines and tunnels or from environments that simulate mines and tunnels.

14.1.3.5* The search and rescue organization shall be capable of responding in a timely manner to rescue summons.

14.1.3.6 The search and rescue organization shall have access to all identified mines and tunnels from which it is required to provide search and rescue services, in order to develop search and rescue plans and practice search and rescue operations according to its designated level of competency.

14.1.4* A mine and tunnel search and rescue team shall be made up of a minimum of five individuals.

14.2 Awareness Level.

14.2.1 Organizations operating at the awareness level for mine and tunnel search and rescue incidents shall meet the requirements specified in Sections 5.2, 7.2, 11.2, and 14.2.

14.2.2 All members of the organization shall meet the requirements of Chapter 4 of NFPA 470 commensurate with the organization's needs.

14.2.3 Organizations operating at the awareness level for mine and tunnel search and rescue incidents shall implement procedures for the following:

(1) Initiating size-up to ascertain immediate response needs at a mine and tunnel search and rescue
(2) Initiating contact and establishing communications with victims where possible
(3)* Recognizing and identifying the hazards associated with nonentry mine and tunnel emergencies
(4)* Recognizing mines and tunnels
(5)* Implementing the emergency response system for mine and tunnel emergencies
(6)* Implementing site control and scene management
(7) Supporting an organization at the operations or technician level while functioning within an IMS

14.3 Operations Level.

14.3.1 Organizations operating at the operations level for mine and tunnel search and rescue incidents shall meet the requirements specified in Sections 14.2 and 14.3.

14.3.2 The organization operating at this level shall be responsible for the development and training of a mine and tunnel rescue team of at least five individuals who are trained, equipped, and available to respond to mine and tunnel emergencies

of a type and complexity that requires an operations-level organization.

14.3.3 Organizations operating at the operations level shall develop and implement procedures for the following:

(1)* Sizing up existing and potential conditions at mine and tunnel emergencies
(2)* Ensuring that personnel are capable of managing the physical and psychological challenges that affect rescuers entering mines and tunnels
(3)* Identifying the duties of team members and the rescue team leader
(4)* Monitoring continuously, or at frequent intervals, the atmosphere in all parts of the space to be entered for oxygen content, flammability (LEL/LFL), and toxicity, in that order
(5)* Providing an approved means of emergency egress respiratory protection with no less than a 30-minute-rated service life that is immediately available to each member of the organization entering a tunnel under construction or related excavation where no immediate atmospheric hazard has been identified
(6)* Performing entry-type rescues into mines and tunnels meeting all of the following specific qualifying characteristics:
    (a) Where the space has been previously surveyed by all team members who might need to enter the space as part of the rescue operation
    (b) Where a written pre-entry plan for the space is in place and is on site that clearly defines the conditions under which the team can enter that specific space
    (c) Where a written rescue plan is in place and on site that specifically defines the types of incidents that might occur in the space and the expected actions of the rescue team for each incident
    (d) Where all members who could be expected to enter the tunnel as part of the rescue plan will have physically practiced the elements of the rescue plan in the actual space or a representative space
    (e) Where the known or suspected hazards for the specific incident are exclusive of any risks attributed to the tunnel environment itself such as fire, hazardous atmosphere, or potential collapse
    (f) Where there are no known or anticipated conditions that would require deviation from the criteria established in the entry and pre-rescue plan
    (g) Where conditions on the worksite or in the tunnel have not changed beyond the scope of those identified in the most recent entry and pre-rescue plan
    (h) Where the internal configuration of the space is clear and unobstructed and rescue can be effected without possibility of entanglement
    (i)* Where rescuers can pass easily through the access/egress opening(s) with room to spare when PPE is worn in the manner recommended by the manufacturer
    (j)* Where the space can accommodate two or more rescuers in addition to the victim
    (k)* Where a previously developed hazard control plan is in place and all identified hazards have been controlled in accordance with the plan
    (l) Where specific criteria for suspending or terminating an entry or rescue operation are clearly identified to all members
    (m) Where contingencies for emergencies during the entry or rescue operation are provided for, such as areas of refuge or intervention methods
(7)* Using victim packaging devices that could be employed in mine and tunnel rescue
(8) Transferring victim information, including location, surroundings, condition when found, present condition, and other pertinent information to emergency medical services personnel
(9) Planning and implementing a mine and tunnel rescue operation
(10)* Selecting, constructing, and using a rope-lowering and -raising system in the high-angle environment
(11) Controlling all identified entry points to the mine/tunnel to prevent unauthorized entry and accounting for all rescuers who might enter the space

14.3.4 Individuals in the organization expected to perform functions at the operations level shall meet the competencies prescribed at the operations level in Chapter 15 of NFPA 1006.

14.4 Technician Level.

14.4.1 Organizations operating at the technician level for mine and tunnel search and rescue emergencies shall meet the requirements of Sections 5.3, 6.3, 7.4, 11.3, 12.3, 14.2, 14.3, and 14.4.

14.4.2 Organizations operating at the technician level shall select and identify for use, positive pressure SCBA with a rated duration that will permit an entry team to complete a rescue mission in spaces of a size or configuration that might be encountered and still provide an adequate reserve to the wearer.

14.4.3* The organization operating at this level shall be responsible for the development of a mine and tunnel rescue team of at least five individuals who are trained, equipped, and available to respond to mine and tunnel emergencies of a type and complexity that requires a technician-level organization.

14.4.3.1* The entry team shall be provided resources designated to aid in their survival and egress should an unanticipated event pose a risk of death or serious injury.

14.4.3.2 Methods selected for providing for the survival of the entry team shall be consistent with the size of the space, travel distances, expected conditions, and the mission and include establishing areas of refuge, increasing the size of the entry team, and staging intervention resources in a manner so they can be accessed by the team if needed.

14.4.3.3* The need for egress-only respiratory protection identified in 14.3.3(5) shall be considered satisfied for members of an entry team who have selected and donned atmosphere-supplying respirators identified by the AHJ for use in the mine or tunnel environment as part of an entry plan to enter a space with a recognized atmospheric hazard, provided the conditions of 14.4.3.7 and 14.4.3.8 have been met.

14.4.3.3.1 There shall be at least one respirator unit per member in the tunnel.

14.4.3.4 Each entry team shall, as a minimum, have the ability to continuously monitor the air for oxygen, carbon monoxide, hydrogen sulfide, and combustible gases as well as any other atmospheric contaminants that are known or suspected.

14.4.3.5* All team members shall be aware of prescribed action levels for specific contaminants or atmospheric conditions.

14.4.3.6* The entry team shall have at least one method of verbal communication with the surface.

14.4.3.7 Entry teams that enter a mine or tunnel with a known atmospheric hazard shall have a clearly defined "turnaround" benchmark to ensure adequate egress to an area of refuge or safety.

14.4.3.8* Each entry team that enters a mine or tunnel with a known or suspected atmospheric hazard shall have at least one additional redundant source of breathable air per team, independent of each wearer's SCBA, to be used in the event of an SCBA failure or "out of air" emergency.

14.4.3.8.1 The redundant air source shall be self-contained and of a capacity to ensure egress of the wearer based on the travel distances.

14.4.3.8.2 The redundant air system shall be independent of any device brought in for use by the victim.

14.4.4 Organizations operating at the technician level for mine and tunnel search and rescue emergencies shall develop and implement procedures for the following:

(1) Performing entry and rescue operations into tunnels for which a pre-entry or pre-rescue plan has not been developed or spaces where those plans are not consistent with conditions at the site
(2) Performing entry and rescue operations in tunnels or spaces where the hazards present could include those that are inherent to the environment such as fire, collapse, and atmospheric hazards
(3) Providing all members who are designated as part of the technician-level team with training in accordance with technician rescuer for mine and tunnel rescue described in NFPA 1006
(4) Providing members of the entry team access to specialized tools and training required to lift loads, move patients, cut steel, break concrete, or other tasks identified as associated with performing rescue operations in a mine or tunnel
(5) Providing members of the entry team with access to and training in respiratory protection such as CCBA or SCBA commensurate with the size and configuration of the spaces and travel distances associated with mines and tunnels
(6)* Evaluating existing and potential conditions at mine and rescue emergencies
(7)* Ensuring that rescue team members take part in a medical surveillance program
(8)* Planning response for entry-type mine and tunnel rescues in hazardous environments
(9)* Implementing the planned response

Chapter 15 Helicopter Search and Rescue (NFPA 1670)

15.1 General Requirements.

15.1.1 Organizations operating at helicopter search and rescue incidents shall meet the requirements specified in Chapter 4.

15.1.2* The AHJ shall evaluate the need for helicopter search and rescue within its response area and shall provide a search and rescue capability commensurate with the identified needs.

15.2 Awareness Level.

15.2.1 Organizations operating at the awareness level for helicopter search and rescue shall meet the requirements specified in Section 15.2.

15.2.2 Organizations operating at the awareness level for helicopter search and rescue shall develop and implement procedures for the following:

(1) Initiating size-up to ascertain immediate response needs for a helicopter search and rescue
(2) Identifying the resources necessary to conduct helicopter search and rescue
(3) Identifying a landing zone or helispot in accordance with the AHJ
(4) Initiating the emergency response system for helicopter search and rescue
(5) Initiating site control and scene management
(6) Ensuring safety in and around landing zones and helicopters in support of helicopter search and rescue
(7)* Recognizing general hazards associated with helicopters and procedures necessary to mitigate these hazards within the operational area
(8)* Identifying PPE required by awareness-level personnel assigned to work in the vicinity of helicopters
(9) Identifying the general uses of helicopters with which the organization could become involved
(10) Establishing communications with the helicopter crew or their agency according to procedures established by the AHJ
(11)* Prior to flying as a passenger on a search and rescue helicopter, ensuring that a preflight safety briefing has been received from the pilot or his designate
(12) Communicating outside the helicopter in accordance with the AHJ
(13) Supporting an organization at the operations or technician level while functioning within an IMS

15.3 Operations Level.

15.3.1 Organizations operating at the operations level for helicopter search and rescue incidents shall meet the requirements specified in Section 15.2.

15.3.2 Organizations operating at the operations level for helicopter search and rescue incidents shall develop and implement procedures commensurate with the identified needs of the organization for the following:

(1) Ensuring safety in and around the helicopter
(2)* Identifying the minimum required crew complement and functions needed for helicopter search and rescue operations
(3) Identifying and selecting the kind and type of helicopter required to perform a specific mission

(4) Maintaining proficiency in procedures involved with in-flight emergencies
(5)* Maintaining proficiency in post-crash egress and survival training appropriate to the environment likely to be encountered
(6) Communicating inside the helicopter in accordance with the AHJ
(7) Performing search observation techniques in accordance with the AHJ
(8) Managing a landing zone or helispot in accordance with the AHJ
(9) Developing an alternate helicopter operational plan in case the primary plan cannot be accomplished

15.4 Technician Level.

15.4.1 Organizations operating at the technician level for helicopter search and rescue shall meet the requirements specified in Sections 5.3, 15.2, 15.3, and 15.4.

15.4.2 Organizations operating at the technician level for helicopter search and rescue shall develop and implement procedures for the following:

(1) Evaluating existing and potential conditions at incidents where helicopter search and rescue operations will be performed
(2) Facilitating operational communications
(3) Performing helicopter search operations, including the provision of trained search observer(s) in a helicopter in accordance with the needs of the AHJ
(4) Performing helicopter rescue operations in accordance with the needs of the AHJ
(5) Identifying, selecting, and utilizing PPE in any environment in which the organization might become involved
(6)* Applying an understanding of the effects of flight on the human body
(7)* Identifying and managing a temporary landing zone or a helispot
(8) Recognizing the factors affecting weight and balance calculations on the aircraft used by the search and rescue organization.
(9) Performing emergency procedures in the aircraft used by the organization
(10) Selecting, constructing, and utilizing both single-point and multiple-point load-sharing anchor systems, both inside and outside the helicopter(s) used by the organization
(11) Reporting information that has the potential to affect helicopter safety operations
(12) Inspecting and using search and rescue equipment in, on, or attached to the helicopter used by the organization

Chapter 16 Surface Water Search and Rescue (NFPA 1670)

16.1 General Requirements. Organizations operating at surface water search and rescue incidents shall meet the requirements specified in Chapter 4.

16.2 Awareness Level.

16.2.1 Organizations operating at the awareness level at surface water search and rescue incidents shall meet the requirements specified in Section 16.2.

16.2.2 Each member of an organization operating at the awareness level shall be a competent person as defined in 3.3.34.

16.2.3 Organizations operating at the awareness level at surface water search and rescue incidents shall implement procedures for the following:

(1) Initiating size-up to ascertain immediate response needs at a surface water search and rescue
(2)* Implementing the assessment phase
(3)* Identifying the resources necessary to conduct safe and effective water operations
(4)* Implementing the emergency response system for surface water rescue incidents
(5)* Implementing site control and scene management
(6)* Recognizing general hazards associated with surface water search and rescue incidents and the procedures necessary to mitigate these hazards within the general search and rescue area
(7)* Determining rescue versus recovery
(8) Supporting an organization at the operations or technician level while functioning within an IMS

16.3 Operations Level.

16.3.1 Organizations operating at the operations level at surface water search and rescue incidents shall meet the requirements specified in Sections 16.2 and 16.3.

16.3.2* Any member of the organization who could be expected to perform functions as a crewmember on a watercraft shall be provided training to meet the job performance requirements for operations-level watercraft operations as defined in NFPA 1006 for the types of watercraft used by the agency under conditions representative of those typically encountered in the work environment.

16.3.3* Any member of the organization who could be expected to perform functions as the operator of a watercraft shall be provided training to meet the job performance requirements for technician-level watercraft operations as defined in NFPA 1006 for the types of watercraft used by the agency under conditions representative of those typically encountered in the work environment.

16.3.4 Organizations operating at the operations level at surface water search and rescue incidents shall develop and implement procedures for performing a risk benefit analysis that shall include the following:

(1)* A survival profile of the potential victim
(2)* A risk profile for the proposed rescue operation

16.3.5* Personnel operating in the hazard zone who are not expected to enter the water as part of the rescue plan shall be provided the following minimum PPE:

(1)* PFD or other PPE approved by the AHJ as designed to provide inherent or on-demand positive buoyancy to the user for the expected tasks and conditions encountered in the specific rescue environment
(2) Whistle or other audible signaling device
(3)* Visible signaling device

16.3.6 Organizations operating at the operations level at surface water search and rescue incidents shall develop and implement procedures for performing nonentry rescue, including the following:

(1)* Initial and ongoing size-up of existing and potential conditions at incidents where surface water search and rescue training and operations will be performed
(2)* Ensuring personal safety at water operations
(3)* Assessing water conditions in terms of hazards to the victim and the rescuer
(4) Separating, isolating, securing, and interviewing witnesses
(5) Evaluating or assessing the potential rescue problems
(6)* Evaluating the progress of the planned response to ensure the objectives are being met
(7)* Conducting shore-based rescue operations
(8)* Using throw bags and related retrieval tools
(9)* Providing assistance to organizations operating at the technician level
(10)* Intervention and self-rescue methods for rescuers who accidentally become immersed
(11)* Identifying and managing heat and cold stress to the rescuer
(12) Using packaging devices identified by the AHJ to be employed for removal of water-bound patients
(13) Transferring victim information, including location, surroundings, condition when found, present condition, and other pertinent information, to emergency medical services personnel
(14)* Using watercraft-assisted and watercraft-based operations if watercraft are used by the organization
(15) Planning to meet operational objectives
(16)* Performing rapid extrication of accessible victims
(17) Performing search operations for missing subjects, which do not require the rescuer to enter the water but that identify areas of highest probability and track progress of the search
(18)* Managing incidents that involve waterbound vehicles, vessels, structures, or other circumstances that pose additional challenges to the rescue operation
(19) Providing a method for accounting for the location of all responders at the scene and ensuring their welfare

16.4 Technician Level.

16.4.1 Organizations operating at the technician level for surface water search and rescue shall meet the requirements in Sections 16.2, 16.3, and 16.4.

16.4.2 Organizations operating at the technician level at surface water search and rescue incidents shall develop and implement the following procedures, which allow for deploying a rescuer or rescuer(s) into the water to conduct a search and rescue task:

(1) Performing a risk benefit analysis based on the victim's projected survival profile and the potential risks the operation poses to the responder
(2) Using a checklist or other method to ensure all required elements of the rescue plan are in place prior to deploying a rescuer into the water
(3)* Providing an intervention plan with specific methods for rescue or removal of rescuers who become injured or fatigued while in the water
(4)* Conducting a search for a missing victim(s) or victims so that the areas of highest probability are identified and progress of the search can be monitored and documented
(5) Methods for managing incidents that involve waterbound vehicles and vessels or other circumstances that pose multiple concurrent challenges to the rescue operation
(6) Providing a method to maintain communication or contact with a rescuer(s) in the water so that the rescuer's location is known and assistance can be summoned immediately

Chapter 17 Swiftwater Search and Rescue (NFPA 1670)

17.1 General Requirements. Organizations operating at swiftwater search and rescue incidents shall meet the requirements specified in Chapter 4.

17.2 Awareness Level.

17.2.1 Organizations operating at the awareness level at swiftwater search and rescue incidents shall meet the requirements specified in Section 17.2.

17.2.2 Each member of an organization operating at the awareness level shall be a competent person as defined in 3.3.34.

17.2.3 Organizations operating at the awareness level at swiftwater search and rescue incidents shall implement procedures for the following:

(1) Initiating size-up to ascertain immediate response needs at a swiftwater search and rescue
(2)* Implementing the assessment phase
(3)* Identifying the resources necessary to conduct swiftwater search and rescue operations
(4)* Implementing the emergency response system for swiftwater search and rescue incidents
(5)* Implementing site control and scene management
(6)* Recognizing general hazards associated with swiftwater search and rescue incidents and the procedures necessary to mitigate these hazards within the general search and rescue area
(7) Determining rescue versus recovery
(8) Supporting an organization at the operations or technician level while functioning within an IMS

17.3 Operations Level.

17.3.1 Organizations operating at the operations level at swiftwater search and rescue incidents shall meet the requirements specified in Sections 16.3 and 17.3.

17.3.2 Organizations operating at the operations level for swiftwater rescue shall make provisions for the access and removal of victims in and around vehicles under conditions representative of the swiftwater environment.

17.3.3 For personnel operating in the hazard zone at a swiftwater search and rescue incident, the minimum PPE provided shall include the following:

(1) Personal flotation device (PFD) intended for use in the swiftwater environment
(2) Thermal protection
(3)* Helmet appropriate for swiftwater rescue
(4) Cutting device that is easily accessible and that will at a minimum cut the ropes and webbing used by the AHJ
(5) Whistle or audible signaling device

17.4 Technician Level.

17.4.1 Organizations operating at the technician level for swiftwater search and rescue shall meet the requirements in Sections 17.2, 17.3, and 17.4.

17.4.2 Organizations operating at the technician level at swiftwater search and rescue incidents shall develop and implement procedures for applying rope rescue techniques in the swiftwater environment.

17.4.3 Organizations operating at the technician level at swiftwater search and rescue incidents shall have the following capabilities:

(1) Constructing and operating rope rescue system anchors and mechanical advantage systems as specified by the AHJ
(2) Constructing a tension diagonal rope system over water
(3) Constructing a highline system over water
(4) Constructing and operating rope systems that position and move a tethered boat controlled by ropes

17.4.4 Organizations operating human-powered watercraft in a swiftwater search and rescue environment shall develop and implement procedures for the use of human-powered watercraft in the swiftwater search and rescue environment.

17.4.5 Organizations operating motorized watercraft in a swiftwater search and rescue environment shall develop and implement procedures for the use of motorized watercraft in the swiftwater search and rescue environment.

Chapter 18 Dive Search and Rescue (NFPA 1670)

18.1 General Requirements. Organizations operating at dive search and rescue incidents shall meet the requirements specified in Chapter 4.

18.2 Awareness Level.

18.2.1 Organizations operating at the awareness level at dive search and rescue incidents shall meet the requirements specified in Section 18.2.

18.2.2 Each member of an organization operating at the awareness level shall be a competent person as defined in 3.3.34.

18.2.3 Organizations operating at the awareness level at dive search and rescue incidents shall implement procedures for the following:

(1) Initiating size-up to ascertain immediate response needs at a dive search and rescue
(2) Initiating size-up to the extent authorized by the AHJ to determine the number of victims and their reported location
(3)* Implementing the assessment phase
(4)* Identifying the resources necessary to conduct dive rescue operations
(5)* Implementing the emergency response system for dive rescue incidents
(6)* Implementing site control and scene management
(7)* Recognizing general hazards associated with dive search and rescue incidents and the procedures necessary to mitigate these hazards within the general search and rescue area
(8)* Determining rescue versus recovery
(9) Supporting an organization at the operations or technician level while functioning within an IMS

18.3 Operations Level.

18.3.1 Organizations operating at the operations level at dive search and rescue incidents shall meet the requirements specified in Sections 18.2 and 18.3.

18.3.2 Organizations operating at the operations level for dive rescue shall be capable of applying the requirements of Section 8.3 under conditions representative of the dive rescue environment.

18.3.3 For personnel operating in the hazard zone at a dive rescue incident, the minimum PPE provided shall include the following:

(1)* Personal flotation device (PFD) or other PPE approved by the AHJ as designed to provide inherent or on-demand positive buoyancy to the user for the expected tasks and conditions encountered in the specific rescue environment
(2) Thermal protection
(3) Whistle or audible signaling device
(4) Cutting tool

18.3.4 Organizations operating at the operations level for dive rescue shall develop and implement procedures for fulfilling the function of a dive tender at a dive rescue incident, including the following:

(1)* Recognizing the unique hazards associated with dive operations
(2)* Serving as surface support personnel, including obtaining and assembling the diver's gear, assisting with donning, and performing all pre-entry checks
(3) Identifying water characteristics
(4)* Operating surface support equipment used in water operations
(5) Procuring the necessary equipment to perform dive operations
(6) Employing techniques for water access, entry, and egress for divers
(7)* Participating in dive operations at any time of day or in any climate the organization encounters
(8) Recognizing conditions or situations where a diver might need assistance
(9) Implementing standardized contingency procedures for dive-related emergencies, including a diver in distress, a missing or injured diver, and related medical emergencies
(10) Providing the necessary medical equipment at the designated egress point to manage medical emergencies commonly associated with compressed gas diving
(11) Tracking and documenting status of divers, including bottom time, location, repetitive dive status, and, when possible, depth
(12) Using standardized methods to communicate with divers while they are on the surface and while submerged
(13) Tracking and documenting the progress of subsurface search operations

18.4 Technician Level.

18.4.1 Organizations operating at the technician level for dive search and rescue shall meet the requirements in Sections 18.2, 18.3, and 18.4.

18.4.2 Organizations operating at the technician level for dive rescue shall apply the requirements of Section 16.4 in a manner consistent with the anticipated conditions of the rescue environment.

18.4.3* The AHJ shall ensure that all members of the organization who are recognized as divers obtain and maintain current dive certification from an agency or organization recognized as providing a curriculum focused on public safety diving.

18.4.4* For all diving members of a technician-level organization, an annual fitness test and a watermanship/skills test and basic scuba skills evaluation supplied by the International Association of Dive Rescue Specialists (IADRS) shall be conducted to maintain public safety diver capability.

18.4.5 Prior to engaging in subsurface operations, any organization operating at the technician level at dive rescue incidents shall make provisions for the following functions whenever divers are in the water, and these functions shall be exclusive of other duties such as supervision, surface support, and standby resources:

(1)* Designating an on-site dive supervisor who has the authority to manage all aspects of the dive operation and has been trained to meet all nondiving job performance requirements of technician-level dive rescue as defined in NFPA 1006
(2) Designating a dive tender who is responsible for assisting divers with assembly and donning of equipment, communicating with divers, tracking their location, and managing subsurface search operations and who has been trained to meet all the job performance requirements of operations-level dive rescue as defined in NFPA 1006
(3)* Designating a safety diver who is equipped and positioned to immediately submerge and lend assistance to a diver in distress or to engage in a search for a missing diver
(4)* Implementing at the direction of the AHJ the mobilization of contingencies specifically intended to sustain or resume the subsurface mission in the event the dive plan requires multiple subsurface divers, or is suspended because of the need to deploy the safety diver or the primary or safety diver cannot fulfill their role

18.4.6 The agency shall ensure that the following equipment is present at the dive site and readily available prior to engaging in subsurface activities:

(1) Medical oxygen and related delivery equipment
(2) Backboard or other device suitable for the movement of a nonambulatory diver
(3) Means of summoning aid without leaving the dive site
(4) A dive flag or float in areas subject to vessel traffic readily visible to vessels approaching the dive location
(5) Copy of the agency's dive emergency response plan
(6) Audible signaling device
(7) Means of immediately recording required information relating to each diver's status and dive profile in a manner that is readily communicated or transferred to other members of the team or medical professionals

18.4.7 Organizations operating at the technician level at dive incidents shall develop and implement procedures for performing public safety scuba diving, including the following:

(1)* Managing a diver's breathing gas supply and bottom time so that on reaching the surface the diver has a minimum reserve pressure that reflects one third of the entire rated capacity of the total primary breathing gas available to the diver and in no case allowing the established minimum reserve pressure for the primary source of breathing gas to be less than 500 psi.
(2) Applying an understanding of physics and physiology as they relate to the diver, diver-related emergencies, and the underwater environment
(3)* Applying dive tables or other methods designated by the AHJ that use a diver's bottom time and depth to determine his/her level of hyperbaric exposure, including the use of letter group designators, any potential decompression obligation, and the ability to perform repetitive dives
(4) Identifying and evaluating underwater environments and conditions to which the public safety diver could be exposed
(5) Identifying and managing the hazards posed by underwater plants and animals
(6) Conducting and supervising dive operations, including planning a dive based on projected depths, bottom times, and available air supply for a particular mission
(7)* Identifying, selecting, and implementing standardized techniques to perform and track the progress of a search that is consistent with the mission of the agency and anticipated conditions that might be encountered in their response area
(8)* Using recognized tools, such as a field neurological exam, to identify divers who are experiencing dive-related maladies, including psychological and physiological stress, air embolism, and decompression sickness
(9) Recognizing and managing the impact of near-drowning in cold water
(10)* Identifying, selecting, and implementing standardized methods of communicating between a submerged diver and the surface so that the diver can immediately summon help, be recalled to the surface, directed in a search pattern, and warned of imminent hazards
(11)* Using redundant and alternative air sources and techniques during low-air or out-of-air emergencies
(12)* Using full-body encapsulation equipment, including dry suits, dry hoods, and dry gloves, with a full-face mask as required by the AHJ, to protect divers from cold or potentially contaminated water
(13)* Rescuing an entangled diver
(14)* Performing pre- and post-entry medical monitoring of divers
(15)* Recovering evidence, including locating, securing, and packaging evidence, documenting and maintaining the chain of custody, and documenting the scene
(16)* Implementing standardized contingency procedures from the agency's dive emergency response plan for rescue operations in the event of primary diver injury, entrapment, loss of communication, and/or disconnect
(17) Using positive connection systems such as chest harnesses and tending lines with quick-release connectors when the use of such systems does not compromise the safety of the diver
(18)* Using standardized written checklists to verify the condition, proper configuration, and operation of a diver's equipment before he/she enters the water
(19) Providing access to and removal of victims in and around vehicles under conditions representative of the dive environment

18.4.8* All diving members of the organization shall have a medical exam conducted by a physician with specific training in hyperbaric exposure and dive-related injuries before engaging in dive operations and annually thereafter.

18.4.9 Organizations operating human-powered watercraft in a dive rescue environment shall develop and implement procedures for the use of human-powered watercraft in the dive rescue environment.

18.4.10 Organizations operating motorized watercraft in a dive rescue environment shall develop and implement procedures for the use of motorized watercraft in the dive rescue environment.

18.4.11* The AHJ shall ensure that all diving members of the organization complete a subsurface task utilizing tools and tactics identified by the AHJ as consistent with the mission of the team under conditions representative of the rescue environment no less than 4 times per 12-month period.

Chapter 19 Ice Search and Rescue (NFPA 1670)

19.1 General Requirements. Organizations operating at ice search and rescue incidents shall meet the requirements specified in Chapter 4.

19.2 Awareness Level.

19.2.1 Organizations operating at the awareness level at ice search and rescue incidents shall meet the requirements specified in Section 19.2.

19.2.2 Each member of an organization operating at the awareness level shall be a competent person as defined in 3.3.34.

19.2.3 Organizations operating at the awareness level at ice search and rescue incidents shall implement procedures for the following:

(1) Initiating size-up to ascertain immediate response needs at an ice search and rescue
(2)* Implementing the assessment phase
(3)* Identifying the resources necessary to conduct ice rescue operations
(4)* Implementing the emergency response system for ice rescue incidents
(5)* Implementing site control and scene management
(6)* Recognizing general hazards associated with ice search and rescue incidents and the procedures necessary to mitigate these hazards within the general search and rescue area
(7) Determining rescue versus recovery
(8) Supporting an organization at the operations or technician level while functioning within an IMS

19.3 Operations Level.

19.3.1 Organizations operating at the operations level at ice search and rescue incidents shall meet the requirements specified in Sections 19.2 and 19.3.

19.3.2 For personnel operating in the hazard zone at an ice search and rescue incident, the minimum PPE provided shall include the following:

(1) Personal flotation device (PFD) or other PPE designed with inherent buoyancy intended for use in the ice rescue environment
(2) Thermal protection
(3) Whistle or audible signaling device
(4) Ice awls/picks

19.3.3 Organizations operating at the operations level for ice search and rescue incidents shall develop and implement procedures for evaluating ice strength and conditions.

19.4 Technician Level.

19.4.1 Organizations operating at the technician level for ice search and rescue incidents shall meet the requirements in Sections 19.2, 19.3, and 19.4.

19.4.2 Organizations operating at the technician level for an ice rescue shall make provisions for the access and removal of victims in and around vehicles under conditions representative of the ice environment.

19.4.3 Organizations operating at the technician level at ice search and rescue incidents shall develop and implement procedures for applying specialized tools and rescue techniques for the ice rescue environment.

19.4.4 Organizations operating human-powered watercraft in an ice search and rescue environment shall develop and implement procedures for the use of human-powered watercraft in the ice search and rescue environment.

19.4.5 Organizations operating motorized watercraft in an ice search and rescue environment shall develop and implement procedures for the use of motorized watercraft in the ice search and rescue environment.

Chapter 20 Surf Search and Rescue (NFPA 1670)

20.1 General Requirements. (Reserved)

20.2 Awareness Level. Organizations operating at surf search and rescue incidents shall meet the requirements specified in Chapter 4.

20.2.1 Organizations operating at the awareness level at surf search and rescue incidents shall meet the requirements specified in Section 20.2.

20.2.2 Each member of an organization operating at the awareness level shall be a competent person as defined in 3.3.34.

20.2.3 Organizations operating at the awareness level at surf search and rescue incidents shall implement procedures for the following:

(1) Initiating size-up to ascertain immediate response needs for a surf search and rescue and conducting nonentry victim location and observation techniques
(2)* Conducting a dynamic size-up and hazard/risk assessment
(3)* Identifying the resources necessary to conduct surf search and rescue operations based on conditions observed
(4)* Implementing the emergency response system for surf search and rescue incidents
(5)* Implementing site control and scene management, including a personnel accountability system

(6)* Recognizing general hazards associated with surf search and rescue incidents and the procedures necessary to mitigate these hazards within the general search and rescue area
(7)* Determining rescue versus recovery
(8) Supporting an organization at the operations or technician level while functioning within an IMS

20.3 Operations Level.

20.3.1 Organizations operating at the operations level at surf search and rescue incidents shall meet the requirements specified in Sections 20.2 and 20.3.

20.3.2 Organizations operating at the operations level for surf search and rescue shall develop and implement procedures for evaluating surf size, strength, and conditions.

20.4 Technician Level.

20.4.1 Organizations operating at the technician level for surf search and rescue shall meet the requirements in Sections 20.2, 20.3, and 20.4.

20.4.2 Organizations operating at the technician level at surf search and rescue incidents shall develop and implement procedures for applying specialized tools and rescue techniques for the surf search and rescue environment.

20.4.3 Organizations operating human-powered watercraft in a surf search and rescue environment shall develop and implement procedures for the use of human-powered watercraft in the surf search and rescue environment.

20.4.4 Organizations operating motorized watercraft in a surf search and rescue environment shall develop and implement procedures for the use of motorized watercraft in the surf search and rescue environment.

Chapter 21 Watercraft Search and Rescue (NFPA 1670)

21.1 General Requirements.

21.1.1 Organizations operating watercraft at search and rescue incidents shall meet the requirements specified in Chapter 4.

21.1.2* This chapter outlines the requirements for use of both human-powered and motorized watercraft to perform search and rescue operations.

21.1.3* The AHJ shall ensure that the requirements of this section are met in a manner consistent with the water and weather conditions typically associated with the agency's projected mission.

21.1.4 No part of this section shall be used to abridge or circumvent certifications or licenses legally required to operate specific watercraft in a particular region, city, or state.

21.2 Awareness Level.

21.2.1 Organizations operating at the awareness level at watercraft search and rescue incidents shall meet the requirements specified in Section 21.2.

21.2.2 Each member of an organization operating at the awareness level shall be a competent person as defined in 3.3.34.

21.2.3 Organizations operating at the awareness level at watercraft search and rescue incidents shall implement procedures for the following:

(1) Initiating size-up to ascertain immediate response needs at a watercraft search and rescue operation
(2) Implementing the assessment phase
(3) Identifying the resources necessary to conduct watercraft search and rescue operations, including launching and recovery sites
(4) Implementing the emergency response system for mobilizing search and rescue watercraft
(5) Implementing site control and scene management
(6) Recognizing general hazards associated with watercraft search and rescue operations and the procedures necessary to mitigate these hazards within the general search and rescue area
(7) Determining rescue versus recovery, if possible
(8) Supporting an organization at the operations or technician level while functioning within an IMS

21.3 Operations Level.

21.3.1 Organizations operating at the operations level at watercraft search and rescue incidents shall meet the requirements specified in Sections 21.2 and 21.3.

21.3.2* Any member of the organization who could be expected to perform functions as a crewmember on a watercraft shall be provided training to meet the job performance requirements for operations-level watercraft operations as defined in NFPA 1006 for the types of watercraft used by the agency under conditions representative of those typically encountered in the work environment.

21.3.3* Personnel operating in or on watercraft who might be exposed to accidental immersion shall wear the following minimum PPE:

(1) Personal flotation device (PFD)
(2) Whistle or other audible signaling device
(3)* Visible signaling device

21.3.4* Organizations operating at the operations level at watercraft search and rescue incidents shall develop and implement procedures for using watercraft in search and rescue operations, including the following:

(1) Identifying the types of watercraft available to the agency and their capabilities, limitations, and any special considerations associated with each type of craft
(2) Identifying the roles of crewmembers for each type of watercraft available to the agency
(3) Providing for the safety of each crewmember and passenger on the watercraft, including methods for accountability and briefing passengers on emergency procedures
(4) Performing an ongoing size-up of existing and potential conditions where watercraft search and rescue operations and training will be performed
(5) Assessing water conditions in terms of hazards to the victim and the rescuer and the capability of the watercraft
(6)* Communicating with other agencies or resources that might be part of a watercraft-based search and rescue operation
(7)* Conducting operations to take a vessel under tow with motorized watercraft, if used by the AHJ

(8)* Conducting watercraft-based operations for deploying and recovering rescuers from the water
(9)* Conducting watercraft-based operations for rescuing and recovering both unconscious and conscious waterbound subjects
(10) Deploying and recovering any watercraft used by the organization
(11)* Deploying crew overboard (COB) measures, including a U.S. Coast Guard–approved Type IV throwable PFD, water rescue throw bags, heaving lines, or similar devices, for passengers or crew who fall overboard
(12) Performing watercraft-based search operations that identify areas of highest probability and areas previously searched
(13) Managing incidents that involve operating around waterbound vehicles, other vessels, submerged hazards, or other circumstances that pose additional challenges to the rescue operation
(14) Identifying navigational aids, such as lights, symbols, or sounds that are used to identify other watercraft, navigational channels, waterway features, or hazards
(15) Identifying and utilizing audible and visual distress signals
(16) Identifying emergency conditions on the watercraft, such as fire or flooding, and implementing required actions

21.4 Technician Level.

21.4.1 Organizations operating at the technician level at watercraft search and rescue incidents shall meet the requirements specified in Sections 21.2, 21.3, and 21.4.

21.4.2* Organizations operating at the technician level at watercraft search and rescue incidents shall develop and implement procedures for operating watercraft in search and rescue operations, including the following:

(1)* Operating a motorized watercraft with a vessel under tow, if used by the AHJ
(2)* Operating a watercraft while deploying and recovering rescuers to and from the water
(3)* Operating a watercraft for recovering both unconscious and conscious waterbound subjects
(4) Using watercraft-specific navigational systems, tools, and techniques so that the position of the craft can be accurately determined and a desired destination reached
(5)* Operating a vessel or watercraft in response to a crew overboard (COB) event, which includes a U.S. Coast Guard–approved Type IV throwable PFD, water rescue throw bags, heaving lines, or similar devices
(6) Operating and navigating watercraft in a search operation that identifies areas of highest probability and documents areas previously searched
(7) Operating watercraft in environments that include waterbound vehicles, vessels, submerged objects, or other hazards that pose additional challenges to the rescue operation
(8) Incorporating the use of navigational aids, such as lights, symbols, or sounds, that are used to identify other watercraft, features, or hazards to reach the intended destination and avoid collisions and groundings

Chapter 22 Flood Search and Rescue (NFPA 1670)

22.1 General Requirements. The AHJ operating at flood search and rescue incidents shall meet the requirements specified in Chapter 4 and Chapter 8.

22.1.1 The AHJ shall evaluate the need for a missing person search in flood incidents that might occur within its response area.

22.1.2 The AHJ shall provide a search capability commensurate with the identified needs.

22.2 Awareness Level.

22.2.1 Members of organizations at the awareness level shall be permitted to assist in support functions on a flood search and rescue operation but shall not be deployed into the floodwater-affected areas.

22.2.2 Organizations operating at the awareness level at any flood search and rescue incident shall have the following capabilities:

(1) Initiating size-up to ascertain immediate response needs at a flood search and rescue incident
(2)* Initiating the emergency response system for flood search and rescue
(3)* Initiating incident management systems suitable to the scale and nature of the flood
(4)* Recognizing the hazards associated with flood search and rescue incidents
(5)* Recognizing the types of floods and the impact to the organization
(6)* Recognizing the different phases of a flood and the impact to the organization
(7) Recognizing the limitations of emergency response skills and equipment in the flood environments
(8) Initiating the collection and recording of information necessary to assist operational personnel in a flood search and rescue incident
(9)* Understanding the social, economic, and political issues associated with flood incidents
(10)* Recognizing and implementing a search marking system suitable for the flood environment
(11) Supporting an organization at the operations or technician level while functioning within an IMS

22.3 Operations Level.

22.3.1 Organizations operating at the operations level at flood search and rescue incidents shall meet the requirements specified in Sections 22.2 and 22.3.

22.3.2 For personnel operating in the hazard zone at a flood search and rescue, the minimum PPE provided shall include the following:

(1) Personal flotation device (PFD) intended for use in the flood environment
(2) Thermal protection
(3) Cutting device that is easily accessible and that will at a minimum cut the ropes and webbing used by the AHJ
(4) Whistle or audible signaling device
(5) PPE consistent with expected contaminated water

22.3.3* Organizations operating at the operations level shall be capable of operating at flood incidents that are limited to requiring a response based on surface water search and rescue operations capabilities on and around flood-affected areas.

22.3.4 Organizations at the operations level shall be permitted to support organizations operating at the technician level but shall not deploy into higher risk, difficult, or complex flood environments.

22.3.5 Organizations operating at the operations level at flood search and rescue incidents shall develop and implement procedures for the following:

(1) Identifying flood characteristics specific to the cause of the flooding and the geographic area flooded
(2) Operating surface support equipment used in flood search and rescue operations
(3)* Identifying and operating watercraft appropriate for use in the flood environment
(4)* Navigating through the flood-affected area
(5) Identifying potential sources of floodwater contamination
(6) Implementing decontamination procedures for personnel, casualties, and equipment

22.4 Technician Level.

22.4.1 Organizations operating at the technician level for flood search and rescue incidents shall meet the requirements in Sections 22.2, 22.3, and 22.4.

22.4.2 Organizations operating at the technician level for flood rescue shall make provisions for the access and removal of victims in and around vehicles under conditions representative of the flood environment.

22.4.3 Organizations operating at the technician level at flood search and rescue incidents shall be capable of operating in, on, and around higher risk, difficult, or complex flood environments and shall have the following capabilities:

(1) Recognizing higher risk, difficult, or complex flood environments, and implementing systems to maximize the safety of responders
(2) Conducting search operations in areas affected by flood waters, including building and structure entries, as required to support the task
(3) Performing extrication and rescue operations involving packaging, treating, and removing victims trapped by floodwaters
(4) Transporting victims to a location where they can be removed from the flood-affected area

22.4.4 Organizations operating at the technician level for flood rescue shall make provisions for the access and removal of victims in and around swiftwater, when those conditions are present.

22.4.5 Organizations operating human-powered watercraft in a flood search and rescue environment shall develop and implement procedures for the use of human-powered watercraft in the flood search and rescue environment.

22.4.6 Organizations operating motorized watercraft in a flood search and rescue environment shall develop and implement procedures for the use of motorized watercraft in the flood search and rescue environment.

Chapter 23 Tower Search and Rescue (NFPA 1670)

23.1 Prerequisites.

23.1.1 Organizations operating at tower rescue incidents shall, as a prerequisite, meet the requirements specified in Chapter 4.

23.1.2* The requirements of this chapter shall apply to organizations that provide varying degrees of response to emergencies involving guyed, self-supporting, monopoles and nonstandard tower structures.

23.1.3 The AHJ, as part of its hazard identification and risk assessment *(see Section 4.3)*, shall identify all locations and situations in the jurisdiction that meet the definition of *towers* and shall make reasonable effort to perform pre-incident rescue action plans with the tower owner, manager, operator, or other AHJ for potential tower emergencies.

23.2 General Requirements.

23.2.1* The rescue organization shall be capable of responding in a timely manner to rescue summons.

23.2.2* The AHJ shall ensure that all members of the tower rescue organization are equipped, trained, and capable of functioning to perform tower rescues within the area for which they are responsible at their designated level of competency.

23.2.2.1 The AHJ shall ensure that all members of the tower rescue organization who ascends a tower in the course of training or rescue is protected from a potential fall with equipment and methods that provide protection that is at least equivalent to the protection that would be expected or required for a worker on the same tower.

23.2.2.2 The AHJ shall ensure that each member of the tower rescue organization is provided with, and trained to use properly, the PPE and rescue equipment necessary for performing rescue from towers according to the designated level of competency.

23.2.2.3 The AHJ shall ensure that a responder to any tower incident that also involves wilderness, water, confined space, machinery, or other disciplines addressed in Chapters 4 through 23, also meets the applicable requirements in Chapters 4 through 23 in those areas.

23.2.3* The AHJ shall ensure that each member of the tower rescue organization is aware of the hazards that could be confronted when called upon to perform rescue in or on towers within the response area of the AHJ, including (but not limited to) radio frequency RF.

23.2.3.1* The AHJ shall ensure that each member of the tower rescue organization who might be called upon to climb the tower is trained in accordance with the outlined requirements described in 23.4.4 for operations-level organizations or 23.5.4 for technician-level organizations.

23.2.3.2 The AHJ shall ensure that each member of the tower rescue organization is trained to identify, avoid, and protect against the following tower-specific hazards:

(1) Those associated with electrical energy, including alternating current (ac), direct current (dc), or fields generated by these currents
(2) Those associated with other types of electromagnetic radiation

23.2.3.3 The AHJ shall ensure that any member of the rescue organization who works in a position where he/she could be exposed to RF radiation (such as on a telecommunications tower) is equipped with and carries on his/her person an RF monitor and shall receive training on lockout/tagout procedures for telecommunications and broadcast towers.

23.2.4 The AHJ shall ensure that each member of the tower rescue organization designated to perform tower rescue shall practice performing tower rescues at a frequency of not less than once every 12 months, by means of simulated rescue operations in which dummies, mannequins, or persons are removed from actual towers or representative structures resembling the type(s), configuration(s), and accessibility of towers to which the tower rescue organization could be required to respond.

23.2.5* The AHJ shall establish a preplan for working with the utility providers in its area, and during any incident involving transmission towers shall consult with utility companies to identify and mitigate electrical hazards before attempting rescue on these or related structures.

23.2.6 The AHJ shall ensure that each member of the tower rescue organization is familiar with the medical conditions likely to exist in a tower rescue emergency (including but not limited to suspension intolerance, electrical burns, and RF exposure) and knows how to treat them during the operation.

23.3 Awareness Level.

23.3.1 Organizations operating at the awareness level for tower rescue incidents shall meet the requirements specified in Section 23.3.

23.3.1.1 Members of organizations at the awareness level shall be permitted to assist in support functions on a tower rescue operation (such as ground support) but shall not be deployed onto the tower.

23.3.1.2* Organizations at the awareness level shall be responsible for removal or retrieval of the subject only in cases where climbing the tower is not required and fall hazards are eliminated.

23.3.2 Organizations operating at the awareness level for tower rescue incidents shall implement procedures for the following:

(1) Initiating size-up to ascertain immediate response needs for tower rescue
(2) Initiating contact and establishing communications with a subject(s) where possible
(3) Initiating the emergency response system for tower rescue
(4) Recognizing different types and purposes of towers with consideration to the information covered in 23.2.3
(5) Performing a retrieval without ascending the structure or tower
(6) Initiating site control and scene management
(7)* Recognizing and identifying the hazards associated with tower emergencies
(8) Recognizing the limitations of conventional emergency response skills and equipment in various tower environments
(9) Initiating the collection and recording of information necessary to assist operational personnel in a tower rescue
(10) Identifying and securing any reporting parties and witnesses
(11) Establishing familiarity with lockout/tagout procedures
(12) Supporting an organization at the operations or technician level while functioning within an IMS

23.4 Operations Level.

23.4.1 Organizations operating at the operations level for tower rescue incidents shall meet the requirements specified in Sections 5.2, 5.3, 23.2, 23.3, and 23.4.

23.4.2 Operations-level organizations are restricted to tower rescue response where all of the following conditions are true:

(1) Where a climbing ladder, integrated tower safety system, or both, are present, and rescuers can access the subject using available PPE and tower climbing techniques consistent with the requirements set forth within this chapter
(2) Where the tower is not structurally compromised
(3) Where the climb path is not obstructed
(4) Where a rescue preplan exists for that particular tower site and advance preparation/planning has been performed with the tower owner/operator
(5) Where the subject can be reached and evacuation performed in accordance with the preplan in such a manner so as to avoid additional hazards, entanglement, or restrictions to the rescue effort
(6) Where the tower can accommodate two or more rescuers in addition to the victim
(7) Where all hazards in and around the tower have been identified, isolated, and controlled
(8) Where the operation is feasible using the equipment or systems with which the organization has been trained
(9) Where the height of the tower does not exceed 300 ft (91.44 m)

23.4.3* Organizations operating at the operations level shall ensure personnel are trained and capable of conducting an operations-level response and are available to respond to a tower incident.

23.4.3.1 Organizations operating at the operations level shall develop and implement procedures for the following:

(1)* Sizing up existing and potential conditions at tower incident sites
(2)* Protecting personnel from hazards on and around the tower environment
(3) Ensuring that personnel are capable of managing the physical and psychological challenges that affect rescuers accessing and climbing towers
(4)* Performing ongoing assessment of conditions affecting the tower rescue operation
(5)* Requesting and interfacing with specialized resources applicable to tower safety
(6) Placing a team of two rescuers on a tower where existing ladder or step bolts and climb protection are present, using accepted tower safety methods and procedures consistent with the requirements of 23.4.4
(7) Performing the following basic rescue techniques with two rescuers on the tower:
    (a) Releasing a subject from fall protection
    (b) Lowering a subject vertically down an unobstructed path

(c) Performing a rescue of a subject where methods require up to a 15-degree deviation from plumb and can be performed with a tag line

(8) Performing selection, care, and use of personal tower climbing equipment
(9) Procuring the necessary tower-site information, including owner and lessor information, site plan, and specific hazard information
(10) Modifying actions and urgency as applicable to a rescue versus a recovery
(11) Acquiring information on current and forecast weather, including temperature, precipitation, lightning potential, and winds
(12) Recognizing, identifying, and using typical fall protection and safety hardware and software used by tower climbers
(13)* Recognizing the team's limitations regarding accessing a subject, evacuating a subject, or both
(14) Recognizing and using engineered anchor points for the rescue operation
(15) Developing of and adhering to contingency plans for when weather or other factors make operations-level response ineffective or dangerous to rescuers

23.4.4 The AHJ shall ensure that each member of the operations-level tower rescue organization who might be responsible for ascending a tower for rescue shall, at a minimum, meet the requirements of operations-level tower rescue in NFPA 1006.

23.4.5 Capabilities shall include, but not be limited to, the ability to demonstrate competency in the principles and use of the following:

(1) Job hazard analysis used on tower sites
(2) 100 percent fall protection
(3) Tower anchorages
(4)* Use of energy-absorbing lanyards
(5)* Use of work-positioning lanyards
(6)* Self-retracting lifelines (SRLs)
(7)* Vertical lifelines for fall arrest
(8)* Ladder climbing safety systems (cable and rail)
(9)* Use of a pre-climb checklist
(10)* Tower ladder/peg climbing techniques
(11) Transferring between the ladder and the tower structure
(12)* Selection and use of appropriate rescue equipment and techniques for a given tower rescue situation

23.5 Technician Level.

23.5.1* Organizations operating at the technician level shall be capable of performing and supervising all aspects of any tower rescue operation with which the organization could become involved.

23.5.1.1 Organizations operating at the technician level for tower rescue emergencies shall meet all of the requirements of Sections 5.2, 5.3, 5.4, 23.3, 23.4, and 23.5.

23.5.2 Technician-level tower rescue capabilities are required for tower rescues where any one or more of the following conditions exist:

(1) Where a climbing ladder or climbing pegs are not present
(2) Where an integrated tower safety system is not present
(3) Where the tower is structurally compromised
(4) Where the site is affected by hazards other than those directly related to the tower or fall protection
(5) Where the climb path is obstructed
(6) Where a rescue preplan does not exist, has been compromised, is infeasible, and/or is not sufficient to resolve the problem at hand
(7) Where the tower cannot accommodate more than one rescuer in addition to the victim
(8) Where the use of standard subject packaging devices, systems, and/or procedures is infeasible
(9) Where the capabilities of operations-level skills are exceeded
(10) Where the height of the tower exceeds 300 ft (91.44 m)

23.5.3* Organizations operating at the technician level for tower rescue emergencies shall be capable of developing and implementing procedures for the following:

(1) Evaluating hazards and establishing a climb plan for an unfamiliar tower
(2) Isolating and controlling electrical hazards on an unfamiliar tower
(3) Identifying and controlling EMF/RF hazards on an unfamiliar tower
(4)* Accessing and rescuing from a tower using non-standard anchorages
(5) Planning and implementing response for tower rescues on unfamiliar towers where ascent of the tower is required
(6)* Placing at least one rescuer on the tower without the benefit of a ladder, step bolts, or integrated fall protection while maintaining 100 percent fall protection at all times
(7) Performing basic rescue techniques, including at least the following, with only one rescuer on the tower:

(a) Releasing a subject from common types of fall protection, including a vertical lifeline (cable), vertical lifeline (rope), fall arrest lanyard, and SRL
(b) Lowering a subject vertically down an obstructed path
(c)* Performing a rescue where the subject must be moved horizontally as well as vertically

23.5.4 Every member of the technician-level tower rescue organization who might be responsible for ascending a tower for rescue shall, at a minimum, meet the requirements of technician-level tower rescue in NFPA 1006.

23.5.5 In addition to meeting the requirements of technician-level tower rescue in NFPA 1006, every member of the technician-level tower rescue organization who might be responsible for ascending a tower shall have demonstrated competency in the following:

(1)* Overseeing others who are using tower rescue equipment and techniques
(2)* Constructing or installing horizontal lifelines
(3)* Tower structure climbing techniques
(4) Transferring between different parts of the structures and between the structure and the rescue system
(5)* Selecting and using rescue equipment and techniques for a tower rescue situation that has not been preplanned

Chapter 24 Certification (NFPA 1983)

24.1 Administration.

24.1.1 Scope.

24.1.1.1 Chapters 24 through 28 shall specify minimum design, performance, testing, and certifications requirements for life safety rope, escape and fire escape rope, throwlines, escape and fire escape webbing, moderate elongation laid life-saving rope, manufacturer-supplied eye terminations, life safety harnesses, belts, victim extrication devices, end-to-end and multiple configuration straps, belay devices, carabiners and snap links, descent control devices, escape anchors, litters, portable anchors, pulleys, rope grab and ascending devices, other auxiliary equipment, escape and fire escape systems, and manufactured systems for emergency services personnel.

24.1.1.2 Chapters 24 through 28 shall not specify requirements for any accessories that could be attached to the certified product but are not necessary for the certified product to meet the requirements of this standard.

24.1.1.3 Chapters 24 through 28 shall not specify requirements for any utility rope.

24.1.1.4 Chapters 24 through 28 shall not specify requirements for any rope or associated equipment designed for mountain rescue, cave rescue, lead climbing operations, or where expected hazards and situations dictate other performance requirements.

24.1.1.5* Chapters 24 through 28 shall not specify requirements for any rope or equipment for fall protection pertaining to employees of general industry or the construction and demolition industry.

24.1.1.6 Chapters 24 through 28 shall not be construed as addressing all of the safety concerns associated with the use of compliant life safety rope or associated equipment. It shall be the responsibility of the persons and organizations that use compliant life safety rope or associated equipment to establish safety and health practices and determine the applicability of regulatory limitations prior to use.

24.1.1.7 Chapters 24 through 28 shall not be construed as addressing all of the safety concerns, if any, associated with the use of this standard by testing facilities. It shall be the responsibility of the persons and organizations that use this standard to conduct testing of life safety rope to establish safety and health practices and determine the applicability of regulatory limitations prior to using this standard for any designing, manufacturing, and testing.

24.1.1.8 Nothing herein shall restrict any jurisdiction or manufacturer from exceeding these minimum requirements.

24.1.2 Purpose.

24.1.2.1* The purpose of Chapters 24 through 28 shall be to establish minimum levels of performance for life safety rope, escape and fire escape rope, throwlines, escape and fire escape webbing, moderate elongation laid life-saving rope, manufacturer-supplied eye terminations, life safety harnesses, belts, victim extrication devices, end-to-end and multiple configuration straps, belay devices, carabiners and snap links, descent control devices, escape anchors, litters, portable anchors, pulleys, rope grab and ascending devices, other auxiliary equipment, escape and fire escape systems, and manufactured systems for emergency services personnel.

24.1.2.2 Controlled laboratory tests used to determine compliance with the performance requirements of Chapters 24 through 28 shall not be deemed as establishing performance for all situations to which this equipment could be exposed.

24.1.2.3 Chapters 24 through 28 are not intended to serve as a detailed manufacturing or purchase specification, but shall be permitted to be referenced in purchase specifications as minimum requirements.

24.1.3 Application.

24.1.3.1 Chapters 24 through 28 shall apply to the design, performance, testing, and certification of new emergency services life safety rope, escape and fire escape rope, throwlines, escape and fire escape webbing, moderate elongation laid life-saving rope, manufacturer-supplied eye terminations, life safety harnesses, belts, victim extrication devices, end-to-end and multiple configuration straps, belay devices, carabiners and snap links, descent control devices, escape anchors, litters, portable anchors, pulleys, rope grab and ascending devices, other auxiliary equipment, escape and fire escape systems, and manufactured systems.

24.1.3.2 Chapters 24 through 28 shall not apply to rope or equipment for use where specific situations dictate other performance requirements such as mountain rescue, cave rescue, lead climbing operations, recreational use, and industrial fall protection for general industry and the construction and demolition industry.

24.1.3.3 This edition shall not apply to any life safety rope or system components manufactured to previous editions of NFPA 1983.

24.1.3.4* Chapters 24 through 28 shall not apply to rope or equipment for operations where personnel are required to work above anchor points.

24.1.3.5 Chapters 24 through 28 shall not apply to use requirements for life safety rope and associated life safety rope equipment because those requirements are specified in NFPA 1500 and NFPA 1858, incorporated in the 2022 edition of this standard.

24.1.3.6 The requirements of Chapters 24 through 28 shall not apply to any accessories that might be attached to any life safety rope or associated life safety rope equipment.

24.2 General.

24.2.1 The process of certification for product as being compliant with NFPA 1983, incorporated in the 2022 edition of this standard, shall meet the requirements of Section 24.2, General; Section 24.3, Certification Program; Section 24.4, Inspection and Testing; Section 24.5, Recertification; Section 24.6, Manufacturer's Quality Assurance Program; Section 24.7, Hazards Involving Compliant Product; Section 24.8, Manufacturers' Investigation of Complaints and Returns; and Section 24.9, Manufacturers' Safety Alert and Product Recall Systems.

24.2.2 All product labeled as being compliant with this standard shall meet or exceed all applicable requirements specified in this standard and shall be certified.

24.2.3 All certification shall be performed by a certification organization that meets at least the requirements specified in Section 24.3 and that is accredited for personal protective equipment in accordance with ISO/IEC 17065, *Conformity assessment — Requirements for bodies certifying products, processes, and services*. The accreditation shall be issued by an accreditation body operating in accordance with ISO 17011, *Conformity assessment — Requirements for accreditation bodies accrediting conformity assessment bodies*.

24.2.4 Manufacturers shall not claim compliance with portions or segments of the requirements of NFPA 1983, incorporated in the 2022 edition of this standard, and shall not use the NFPA name or the name or identification of this standard in any statements about their respective products unless the products are certified as compliant to this standard.

24.2.5 All compliant products shall be labeled and listed.

24.2.6 All compliant products shall also have a product label that meets the requirements specified in Chapter 25, Labeling and Information.

24.2.7* The certification organization's label, symbol, or identifying mark shall be part of the product label, shall be attached to the product label, or shall be immediately adjacent to the product label.

24.2.8 The certification organization shall not issue any new certifications to the 2017 edition of NFPA 1983 on or after the NFPA effective date for NFPA 1983, incorporated in the 2022 edition of this standard.

24.2.9 The certification organization shall not permit any manufacturer to continue to label any products that are certified as compliant with the 2017 edition of NFPA 1983 after [effective date, plus 12 months].

24.2.10 The certification organization shall require manufacturers to remove all certification labels and product labels indicating compliance with the 2017 edition of NFPA 1983 from all protective ensembles and ensemble elements that are under the control of the manufacturer on [effective date, plus 12 months], and the certification organization shall verify this action is taken.

24.3 Certification Program.

24.3.1* The certification organization shall not be owned or controlled by manufacturers or vendors of the product being certified.

24.3.2 The certification organization shall be primarily engaged in certification work and shall not have a monetary interest in the product's ultimate profitability.

24.3.3 The certification organization shall be accredited for personal protective equipment in accordance with ISO/IEC 17065, *Conformity assessment — Requirements for bodies certifying products, processes, and services*. The accreditation shall be issued by an accreditation body operating in accordance with ISO 17011, *Conformity assessment — Requirements for accreditation bodies accrediting conformity assessment bodies*.

24.3.4 The certification organization shall refuse to certify products to this standard that do not comply with all applicable requirements of this standard.

24.3.5* The contractual provisions between the certification organization and the manufacturer shall specify that certification is contingent on compliance with all applicable requirements of this standard.

24.3.5.1 The certification organization shall not offer or confer any conditional, temporary, or partial certifications.

24.3.5.2 Manufacturers shall not be authorized to use any label or reference to the certification organization on products that are not compliant with all applicable requirements of this standard.

24.3.6* The certification organization shall have laboratory facilities and equipment available for conducting proper tests to determine product compliance.

24.3.6.1 The certification organization laboratory facilities shall have a program in place and functioning for calibration of all instruments, and procedures shall be in use to ensure proper control of all testing.

24.3.6.2 The certification organization laboratory facilities shall follow good practice regarding the use of laboratory manuals, form data sheets, documented calibration and calibration routines, performance verification, proficiency testing, and staff qualification and training programs.

24.3.7 The certification organization shall require the manufacturer to establish and maintain a quality assurance program that meets the requirements of Section 24.6, Manufacturer's Quality Assurance Program.

24.3.7.1* The certification organization shall require the manufacturer to have a product recall system as specified in Section 24.9, Manufacturers' Safety Alert and Product Recall Systems, as part of the manufacturer's quality assurance program.

24.3.7.2 The certification organization shall audit the manufacturer's quality assurance program to ensure that the quality assurance program provides continued product compliance with this standard.

24.3.8 The certification organization and the manufacturer shall evaluate any changes affecting the form, fit, or function of the compliant product to determine its continued certification to this standard.

24.3.9* The certification organization shall have a follow-up inspection program of the manufacturing facilities of the compliant product with at least two random and unannounced visits per 12-month period to verify the product's continued compliance.

24.3.9.1 Where portions of the production process are carried out by multiple facilities, the certification organization shall determine the appropriate follow-up program according to which facility or facilities most closely meet the definition provided in 3.3.134.

24.3.9.2 As part of the follow-up inspection program, the certification organization shall select sample compliant product at random from the manufacturing facility's production line, from the manufacturing facility's in-house stock, or from the open market.

24.3.9.3 Sample product shall be evaluated by the certification organization to verify the product's continued compliance to ensure that the materials, components, and manufacturing quality assurance systems are consistent with the materials, components, and manufacturing quality assurance that were

inspected and tested by the certification organization during initial certification and recertification.

24.3.9.4 The certification organization shall be permitted to conduct specific testing to verify the product's continued compliance.

24.3.9.5 For products, components, and materials where prior testing, judgment, and experience of the certification organization have shown results to be in jeopardy of not complying with this standard, the certification organization shall conduct more frequent testing of sample product, components, and materials acquired in accordance with 24.3.9.2 against the applicable requirements of this standard.

24.3.10 The certification organization shall have in place a series of procedures, as specified in Section 24.7, Hazards Involving Compliant Product, that address reports of situations in which a compliant product is subsequently found to be hazardous.

24.3.11 The certification organization's operating procedures shall provide a mechanism for the manufacturer to appeal decisions. The procedures shall include the presentation of information from both sides of a controversy to a designated appeals panel.

24.3.12 The certification organization shall be in a position to use legal means to protect the integrity of its name and label. The name and label shall be registered and legally defended.

24.4 Inspection and Testing.

24.4.1 For both initial certification and recertification of compliant products, the certification organization shall conduct both inspection and testing as specified in this section.

24.4.2 All inspections, evaluations, conditioning, and testing for certification or for recertification shall be conducted by a certification organization's testing laboratory that is accredited in accordance with the requirements of ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories*.

24.4.2.1 The certification organization's testing laboratory's scope of accreditation to ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories*, shall encompass testing of personal protective equipment.

24.4.2.2 The accreditation of a certification organization's testing laboratory shall be issued by an accreditation body operating in accordance with ISO 17011, *Conformity assessment — Requirements for accreditation bodies accrediting conformity assessment bodies*.

24.4.3 A certification organization shall be permitted to utilize conditioning and testing results conducted by a product or component manufacturer for certification or recertification provided the manufacturer's testing laboratory meets the requirements specified in 24.4.3.1 through 24.4.3.5.

24.4.3.1 The manufacturer's testing laboratory shall be accredited in accordance with the requirements of ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories*.

24.4.3.2 The manufacturer's testing laboratory's scope of accreditation to ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories*, shall encompass testing of personal protective equipment.

24.4.3.3 The accreditation of a manufacturer's testing laboratory shall be issued by an accreditation body operating in accordance with ISO 17011, *Conformity assessment — Requirements for accreditation bodies accrediting conformity assessment bodies*.

24.4.3.4 The certification organization shall approve the manufacturer's testing laboratory.

24.4.3.5 The certification organization shall determine the level of supervision and witnessing of the conditioning and testing for certification or recertification conducted at the manufacturer's testing laboratory.

24.4.4 Sampling levels for testing and inspection shall be established by the certification organization and the manufacturer to ensure a reasonable and acceptable reliability at a reasonable and acceptable confidence level that products certified to this standard are compliant, unless such sampling levels are specified herein.

24.4.5 Inspection by the certification organization shall include a review of all product labels to ensure that all required label attachments, compliance statements, certification statements, and other product information as applicable are at least as specified for the products identified in Chapter 25.

24.4.6 Inspection by the certification organization shall include an evaluation of any symbols and pictorial graphic representations used on product labels or in user information, as permitted in Chapter 25, to ensure that the symbols are clearly explained in the product's user information package.

24.4.7 Inspection by the certification organization shall include a review of the user information required by Chapter 25 to ensure that the information has been developed and is available.

24.4.8 Inspection by the certification organization for determining compliance with the design requirements specified in Chapter 26 shall be performed on whole or complete products.

24.4.9 Testing to determine product compliance with the performance requirements specified in Chapter 27 shall be conducted by the certification organization in accordance with the specified testing requirements of Chapter 28.

24.4.9.1 Testing shall be performed on specimens representative of materials and components used in the actual construction of the compliant product.

24.4.9.2 The certification organization also shall be permitted to use sample materials cut from a representative product.

24.4.10 The certification organization shall accept from the manufacturer, for evaluation and testing for certification, only product or product components that are the same in every respect to the actual final product or product component.

24.4.11 The certification organization shall not allow any modifications, pretreatment, conditioning, or other such special processes of the product or any product component prior to the product's submission for evaluation and testing by the certification organization.

24.4.12 The certification organization shall not allow the substitution, repair, or modification, other than as specifically permitted herein, of any product or any product component during testing.

24.4.13 The certification organization shall not allow test specimens that have been conditioned and tested for one method to be reconditioned and tested for another test method unless specifically permitted in the test method.

24.4.14 Any change in the design, construction, or material of a compliant product shall necessitate new inspection and testing to verify compliance to all applicable requirements of this standard that the certification organization determines can be affected by such change. This recertification shall be conducted before labeling the modified product as being compliant with this standard.

24.4.15 The manufacturer shall maintain all design and performance inspection and test data from the certification organization used in the certification of the manufacturer's compliant product. The manufacturer shall provide such data, upon request, to the purchaser or authority having jurisdiction.

24.5 Recertification.

24.5.1 All products that are labeled as being compliant with this standard shall undergo recertification in accordance with Table 24.5.1.

24.5.1.1 This recertification shall include inspection and evaluation to the design requirements and testing to the performance requirements as required by this standard on all manufacturers' compliant product models.

24.5.1.2 Any change that affects the compliant product performance under design or performance requirements of this standard shall constitute a different model.

24.5.1.3 For the purpose of this standard, models shall include each unique pattern, style, or design of the compliant products.

24.5.2 Samples of manufacturer's models and components for recertification shall be acquired from the manufacturer or component supplier during random and unannounced visits as part of the follow-up program specified in 24.3.9.

24.5.2.1 For recertification, the certification organization shall acquire at least one complete compliant product.

24.5.2.2 The certification organization shall also acquire a sufficient quantity of components to be tested for recertification as required by 24.5.3.

24.5.3 Compliant products and components shall be inspected, evaluated, and tested as specified in 24.5.3.1 and 24.5.3.2. Inspection, evaluation, and testing performed as part of the follow-up program shall be permitted to be used for recertification to avoid duplication.

24.5.3.1 A minimum of one sample of each compliant product shall be inspected and evaluated to the design requirements specified in Chapter 26.

24.5.3.2 A minimum of one sample of each compliant product and component shall be tested for overall performance as specified in Chapter 27 and as listed in Table 24.5.1.

24.5.4 The manufacturer shall maintain all design, inspection, performance, and test data from the certification organization produced during the recertification of the manufacturer's models and components. The manufacturer shall provide such data upon request to the purchaser or to the authority having jurisdiction (AHJ).

24.6 Manufacturer's Quality Assurance Program.

24.6.1 The manufacturer shall provide and operate a quality assurance program that meets the requirements of this section and that includes a product recall system as specified in 24.3.7.1, and Section 24.9, Manufacturers' Safety Alert and Product Recall Systems.

24.6.2 The operation of the quality assurance program shall evaluate and test compliant product production to the requirements of this standard to assure production remains in compliance.

24.6.3 All of the following shall be either registered to ISO 9001, *Quality management systems — Requirements*, or listed as a registered entity covered location under ISO 9001.

(1) Manufacturer
(2) Manufacturing facility
(3) Entity that directs and controls compliant product design
(4) Entity that directs and controls compliant product quality assurance
(5) Entity that provides warranty for the compliant product
(6) Entity that puts its name on the product label and markets and sells the product as its own

24.6.3.1 Registration to the requirements of ISO 9001, *Quality management systems — Requirements*, shall be conducted by a registrar that is accredited for personal protective equipment in accordance with ISO/IEC 17021, *Conformity assessment — Requirements for bodies providing audit and certification of management systems*. The registrar shall affix the accreditation mark on the ISO registration certificate.

24.6.3.2 The scope of the ISO registration shall include at least the design and manufacturing systems management for the type of personal protective equipment being certified.

24.6.4* Any entity that meets the definition of *manufacturer* specified in Section 3.3, General Definitions, and therefore is considered the "manufacturer," but does not manufacture or assemble the compliant product, shall meet the requirements specified in Section 24.6.

24.6.5* Where the manufacturer uses subcontractors in the construction or assembly of the compliant product, the locations and names of all subcontractor facilities shall be documented and the documentation shall be provided to the manufacturer's ISO registrar and to the certification organization.

24.7 Hazards Involving Compliant Product.

24.7.1* The certification organization shall establish procedures to be followed where situation(s) are reported in which a compliant product is subsequently found to be hazardous. These procedures shall comply with the provisions of ISO Guide 27, *Guidelines for corrective action to be taken by a certification body in the event of misuse of its mark of conformity*, and as modified herein.

24.7.2* Where a report of a hazard involved with a compliant product is received by the certification organization, the validity of the report shall be investigated.

24.7.3 With respect to a compliant product, a hazard shall be a condition or create a situation that results in exposing life, limb, or property to an imminently dangerous or dangerous condition.

Table 24.5.1 Recertification Schedule

Product	Test	Time
All component product	Corrosion testing	Initial cert only
All component product	Product label durability tests	Initial cert only
Throwlines	Rope breaking	Every year
Throwlines	Floatability	Every year
Life safety harness	Static	Alternating years with drop test
Life safety harness	Drop	Alternating years with static test
Belt	Static	Alternating years with drop test
Belt	Drop	Alternating years with static test
Carabiners and snap-links	All	Every 2 years
Rope grab and ascending devices	All	Every 2 years
Descent control devices — auto stop	Holding test	Every year
Descent control devices — auto stop	Manner of function	Every year
Descent control devices — non-auto-stop	All	Every 2 years
Portable anchor	All	Initial cert only
Pulley	All	Every 2 years
Multiple configuration and end-to-end straps	Breaking strength	Every year
Manufactured systems	All	Every year
Escape systems	All	Every year
Life safety rope	Diameter, rope breaking, and elongation	Every year
Life safety rope fibers	Melting and crystallization temperatures by thermal analysis	Every year
Escape rope and fire escape rope	Diameter, rope breaking, and elongation	Every year
Fire escape rope	Elevated rope temperature test	Every year
Escape rope fibers	Melting and crystallization temperatures by thermal analysis	Every year
Escape webbing and fire escape webbing	Perimeter, rope breaking, and elongation	Every year
Fire escape webbing	Elevated rope temperature test	Every year
Escape webbing fibers	Melting and crystallization temperatures by thermal analysis	Every year
Moderate elongation laid life-saving rope	Diameter, rope breaking, and elongation	Every year
Moderate elongation laid life life-saving rope fibers	Melting and crystallization temperatures by thermal analysis	Every year
Victim extrication devices	Static	Every 2 years
Litters	Litter strength test — vertical	Alternating years with horizontal
Litters	Litter strength test — horizontal	Alternating years with vertical
Load-bearing textiles used in victim extrication devices	Melting and crystallization temperatures by thermal analysis	Every year
Thread used in victim extrication devices	Melting and crystallization temperatures by thermal analysis	Every year
Webbing components	Melting and crystallization temperatures by thermal analysis	Every year
Thread components	Melting and crystallization temperatures by thermal analysis	Every year
Load-bearing textiles used in belts with optional flame resistance	Flame resistance	Every year
Load-bearing textiles used in belts with optional flame resistance	Heat resistance	Every year
Hardware installed in belts with optional flame resistance	Heat resistance	Every year
Thread used in belts with optional flame resistance	Thread heat resistance	Every year
Load-bearing textiles used in life safety harnesses with optional flame resistance	Flame resistance	Every year
Load-bearing textiles used in life safety harnesses with optional flame resistance	Heat resistance	Every year
Hardware installed in life safety harnesses with optional flame resistance	Heat resistance	Every year
Thread used in life safety harnesses with optional flame resistance	Thread heat resistance	Every year
Manufacturer-supplied eye termination	Breaking strength	Every year
Manufacturer-supplied eye termination	Thread melting	Every year
Belay devices	Manner of function	Every 2 years
Other auxiliary equipment	All	Every 2 years
Escape anchors	All	Every 2 years
Fire escape systems	All	Every year

24.7.4 Where a specific hazard is identified, the determination of the appropriate action for the certification organization and the manufacturer to undertake shall take into consideration the severity of the hazard and its consequences to the safety and health of users.

24.7.5 Where it is established that a hazard is involved with a compliant product, the certification organization shall determine the scope of the hazard including products, model numbers, serial numbers, factory production facilities, production runs, and quantities involved.

24.7.6 The certification organization's investigation shall include, but not be limited to, the extent and scope of the problem as it might apply to other compliant products or compliant product components manufactured by other manufacturers or certified by other certification organizations.

24.7.7 The certification organization shall also investigate reports of a hazard where compliant product is gaining widespread use in applications not foreseen when the standard was written, such applications in turn being ones for which the product was not certified, and no specific scope of application has been provided in the standard, and no limiting scope of application was provided by the manufacturer in written material accompanying the compliant product at the point of sale.

24.7.8 The certification organization shall require the manufacturer of the compliant product, or the manufacturer of the compliant product component if applicable, to assist the certification organization in the investigation and to conduct its own investigation as specified in Section 24.8, Manufacturers' Investigation of Complaints and Returns.

24.7.9 Where the facts indicating a need for corrective action are conclusive and the certification organization's appeal procedures referenced in 24.3.11 have been followed, the certification organization shall initiate corrective action immediately, provided there is a manufacturer to be held responsible for such action.

24.7.10 Where the facts are conclusive and corrective action is indicated, but there is no manufacturer to be held responsible, such as when the manufacturer is out of business or the manufacturer is bankrupt, the certification organization shall immediately notify relevant governmental and regulatory agencies and issue a notice to the user community about the hazard.

24.7.11* Where the facts are conclusive and corrective action is indicated, the certification organization shall take one or more of the following corrective actions:

(1) Notification of parties authorized and responsible for issuing a safety alert when, in the opinion of the certification organization, such a notification is necessary to inform the users.
(2) Notification of parties authorized and responsible for issuing a product recall when, in the opinion of the certification organization, such a recall is necessary to protect the users.
(3) Removal of the mark of certification from the product.
(4) Where a hazardous condition exists and it is not practical to implement 24.7.11(1), 24.7.11(2), or 24.7.11(3); or the responsible parties refuse to take corrective action, the certification organization shall notify relevant governmental and regulatory agencies and issue a notice to the user community about the hazard.

24.7.12 The certification organization shall provide a report to the organization or individual identifying the reported hazardous condition and notify that organization or individual of the corrective action indicated, or that no corrective action is indicated.

24.7.13* Where a change to an NFPA standard(s) is felt to be necessary, the certification organization shall also provide a copy of the report and corrective actions indicated to NFPA and shall also submit either a Public Input for a proposed change to the next revision of the applicable standard or a proposed Temporary Interim Amendment (TIA) to the current edition of the applicable standard.

24.8 Manufacturers' Investigation of Complaints and Returns.

24.8.1 Manufacturers shall provide corrective action in accordance with ISO 9001, *Quality management systems — Requirements*, for investigating written complaints and returned products.

24.8.2 Manufacturers' records of returns and complaints related to safety issues shall be retained for at least 5 years.

24.8.3 Where the manufacturer discovers, during the review of specific returns or complaints, that a compliant product or compliant product component can constitute a potential safety risk to end users that is possibly subject to a safety alert or product recall, the manufacturer shall immediately contact the certification organization and provide all information about its review to assist the certification organization with the investigation.

24.9 Manufacturers' Safety Alert and Product Recall Systems.

24.9.1 Manufacturers shall establish a written safety alert system and a written product recall system that describes the procedures to be used in the event that it decides, or is directed by the certification organization, to either issue a safety alert or to conduct a product recall.

24.9.2 The manufacturers' safety alert and product recall system shall provide the following:

(1) The establishment of a coordinator and responsibilities by the manufacturer for the handling of safety alerts and product recalls
(2) A method of notifying all dealers, distributors, purchasers, users, and NFPA about the safety alert or product recall that can be initiated within a 1-week period following the manufacturer's decision to issue a safety alert or to conduct a product recall, or after the manufacturer has been directed by the certification organization to issue a safety alert or conduct a product recall
(3) Techniques for communicating accurately and understandably the nature of the safety alert or product recall and in particular the specific hazard or safety issue found to exist
(4) Procedures for removing product that is recalled and for documenting the effectiveness of the product recall
(5) A plan for repairing, replacing, or compensating purchasers for returned product

Chapter 25 Labeling and Information (NFPA 1983)

25.1 Life Safety Rope.

25.1.1 Life Safety Rope Label Requirements.

25.1.1.1 Each life safety rope item shall have a product label.

25.1.1.2 Where life safety rope is an integral and nonseparable piece of a manufactured system and that manufactured system is certified as compliant with this standard, the life safety rope shall be required to have at least the continuous identification tape specified in 25.1.1.13.

25.1.1.3 The life safety rope product label shall be permitted to be a hang tag affixed to each individual life safety rope or shall be permitted to be printed on a sheet that is inserted and sealed in the packaging that immediately contains the life safety rope.

25.1.1.4 All letters shall be at least 2 mm (5⁄64 in.) high.

25.1.1.5 All worded portions of the required product label shall at least be in English.

25.1.1.6 Symbols and other pictorial graphic representations shall be permitted to be used to supplement worded statements on the product label(s).

25.1.1.7 The certification organization's label, symbol, or identifying mark shall be printed on the product label. All letters shall be at least 2.5 mm (3⁄32 in.) high.

25.1.1.8 Each life safety rope shall have the following compliance statement on the product label:

MEETS THE LIFE SAFETY ROPE REQUIREMENTS OF NFPA 1983, INCORPORATED IN THE 2022 EDITION OF NFPA 2500.

CLASS: _____-USE ROPE

25.1.1.9 The class designation of the life safety rope that is required in 25.1.1.8 to be stated on the product label shall be as determined by the certification organization in accordance with Section 27.1.

25.1.1.10 In addition to the compliance statement specified in 25.1.1.8, at least the following information shall be provided on the product label:

MINIMUM BREAKING STRENGTH: _____ kN

DIAMETER: _____ mm

Type of fiber(s) _____

25.1.1.11 The minimum breaking strength (MBS) value of the life safety rope, which is required in 25.1.1.10 to be stated on the product label, shall be permitted to be any value greater than the actual "pass" requirement value determined by the certification testing in accordance with 27.1.1 or 27.1.2, as applicable, but shall not be greater than the calculated MBS.

25.1.1.12 The diameter of the life safety rope, which is required in 25.1.1.10 to be stated on the product label, shall be as determined by the certification organization in accordance with 27.1.3 or 27.1.4, as applicable.

25.1.1.13* In addition to the compliance statement specified in 25.1.1.8, each life safety rope shall also be marked for its full length by insertion of a continuous identification tape(s). At least the following statement and information shall be printed on the tape not less than every 1 m (39 in.):

[MEETS REQUIREMENTS FOR LIFE SAFETY ROPE OF NFPA 2500 (1983), 2022 ED.]

[Certification organization's label, symbol, or identifying mark]

[Name of manufacturer]

[Year and quarter of manufacture (not coded)]

25.1.1.14 In addition to the compliance and information statements in 25.1.1.8 and 25.1.1.10, at least the following information shall also be printed on the product label(s) where all letters shall be at least 2 mm (5⁄64 in.) high.

(1) Manufacturer's name, identification, or designation
(2) Manufacturer's address
(3) Country of manufacture
(4) Manufacturer's product identification
(5) Model, style, lot, or serial number
(6) Elongation at 1.35 kN (300 lbf)
(7) Elongation at 2.7 kN (600 lbf)
(8) Elongation at 4.4 kN (1000 lbf)

25.1.2 Life Safety Rope User Information.

25.1.2.1 The manufacturer of life safety rope that is certified as being compliant with this standard shall furnish the purchaser with at least use criteria, inspection procedures, maintenance procedures, cleaning procedures, and retirement criteria for the product.

25.1.2.2 The manufacturer shall provide information for the user to consider prior to reusing life safety rope, including that the rope be considered for reuse only if all of the following conditions are met:

(1) Rope has not been visually damaged.
(2) Rope has not been exposed to heat, direct flame impingement, or abrasion.
(3) Rope has not been subjected to any impact load.
(4) Rope has not been exposed to liquids, solids, gases, mists, or vapors of any chemical or other material that can deteriorate rope.
(5) Rope passes inspection when inspected by a qualified person following the manufacturer's inspection procedures both before and after each use.

25.1.2.3 The manufacturer shall provide information for the user regarding not using the life safety rope and removing the rope from service if the rope does not meet all of the conditions in 25.1.2.2, if the rope does not pass inspection, or if there is any doubt about the safety or serviceability of the rope.

25.1.2.4 The manufacturer shall provide information for the user regarding at least the following issues:

(1)* Inspecting the rope periodically according to the manufacturer's inspection procedure
(2) Removing the rope from service and destroying it if the rope does not pass inspection or if there is any doubt about the safety or serviceability of the rope
(3) Protecting the rope from abrasion
(4) Not exposing the rope to flame or high temperature and carrying the rope where it will be protected as the rope could melt or burn and fail if exposed to flame or high temperature

(5) Keeping the product label and user instructions/information after they are removed/separated from the rope and retaining them in the permanent rope record; copying the product label and user instructions/information and keeping the copies with the rope
(6) Referring to the user instructions/information before and after each use
(7) Cautioning that, if the instructions/information are not followed, the user could suffer serious consequences

25.1.2.5 The manufacturer shall provide information for the user that additional information regarding life safety rope can be found in NFPA 1500 and NFPA 1858 and NFPA 1983, incorporated in the 2022 edition of this standard.

25.1.2.6 The manufacturer of life safety rope that is certified as being compliant with this standard shall furnish the purchaser with a sample of suggested records to be maintained by the purchaser or user of life safety rope and a list of items that the records need to contain.

25.2 Escape Rope.

25.2.1 Escape Rope Label Requirements.

25.2.1.1 Each escape rope item shall have a product label.

25.2.1.2* Where escape rope is an integral and nonseparable piece of a manufactured system and that manufactured system is certified as compliant with this standard, the escape rope shall be required to have at least the continuous identification tape specified in 25.2.1.12.

25.2.1.3 The escape rope product label shall be permitted to be a hang tag affixed to each escape rope or shall be permitted to be printed on a sheet that is inserted and sealed in the packaging that immediately contains the escape rope.

25.2.1.4 All letters shall be at least 2.0 mm ($\frac{5}{64}$ in.) high.

25.2.1.5 All worded portions of the required product label shall at least be in English.

25.2.1.6 Symbols and other pictorial graphic representations shall be permitted to be used to supplement worded statements on the product label(s).

25.2.1.7 The certification organization's label, symbol, or identifying mark shall be printed on the product label. All letters shall be at least 2.5 mm ($\frac{3}{32}$ in.) high.

25.2.1.8 Each escape rope shall have the following compliance statement on the product label:

MEETS THE ESCAPE ROPE REQUIREMENTS OF NFPA 1983, INCORPORATED IN THE 2022 EDITION OF NFPA 2500.

25.2.1.9* In addition to the compliance statement specified in 25.2.1.8, at least the following information shall be provided on the product label.

MINIMUM BREAKING STRENGTH: _____ kN

DIAMETER: _____ mm

Type of fiber(s) _____

25.2.1.10 The MBS value of the escape rope, which is required in 25.2.1.9 to be stated on the product label, shall be permitted to be any value greater than the actual "pass" requirement value determined by the certification testing in accordance with 27.2.1, but shall not be greater than the calculated MBS.

25.2.1.11 The diameter of the escape rope, which is required in 25.2.1.9 to be stated on the product label, shall be as determined by the certification organization in accordance with 27.2.2.

25.2.1.12* In addition to the compliance statement specified in 25.2.1.8, each escape rope shall also be marked for its full length by insertion of a continuous identification tape(s). At least the following statement and information shall be printed on the tape not less than every 1 m (39 in.):

[MEETS REQUIREMENTS FOR ESCAPE ROPE OF NFPA 2500 (1983), 2022 ED.]

[Certification organization's label, symbol, or identifying mark]

[Name of manufacturer]

[Year and quarter of manufacture (not coded)]

25.2.1.13 In addition to the compliance and information statements in 25.2.1.8 and 25.2.1.9 at least the following information shall also be printed on the product label(s)where all letters shall be at least 2 mm ($\frac{5}{64}$ in.) high.

(1) Manufacturer's name, identification, or designation
(2) Manufacturer's address
(3) Country of manufacture
(4) Manufacturer's product identification
(5) Model, style, lot, or serial number
(6) Elongation at 1.35 kN (300 lb)
(7) Elongation at 2.7 kN (600 lb)
(8) Elongation at 4.4 kN (1000 lb)

25.2.2 Escape Rope User Requirements.

25.2.2.1 The manufacturer of escape rope, escape webbing, fire escape rope, and fire escape webbing that are certified as being compliant with this standard shall furnish the purchaser with at least use criteria, inspection procedures, cleaning procedures, maintenance procedures, and retirement criteria for the product.

25.2.2.2 The manufacturer shall provide information for the user regarding at least the following issues:

(1) Using the rope only with a life safety harness or escape belt
(2) Inspecting the rope periodically according to the manufacturers' inspection procedure
(3) Removing the rope from service and destroying it if the rope does not pass inspection or if there is any doubt about the safety or serviceability of the rope
(4) Protecting the rope from abrasion
(5) Not exposing the rope to flame or high temperature and carrying the rope where it will be protected as the rope could melt or burn and fail if exposed to flame or high temperature
(6) Keeping the product label and user instructions/information after they are removed/separated from the rope for future reference
(7) Referring to the user instructions/information before and after each use
(8) Cautioning that, if the instructions/information are not followed, the user could suffer serious consequences

25.2.2.3 The manufacturer shall provide information for the user that additional information regarding escape rope can be found in NFPA 1500 and NFPA 1858 and NFPA 1983, incorporated in the 2022 edition of this standard.

25.2.2.4 The manufacturer of escape rope, escape webbing, fire escape rope, and fire escape webbing that is certified as being compliant with this standard shall furnish the purchaser with a sample of suggested records to be maintained by the purchaser or user of escape rope, escape webbing, fire escape rope, and fire escape webbing and a list of items that the records need to contain.

25.3 Escape Webbing.

25.3.1 Escape Webbing Label Requirements.

25.3.1.1 Escape webbing shall meet the labeling requirements in 25.2.1, excluding 25.2.1.8, 25.2.1.9, 25.2.1.10, 25.2.1.11, and 25.2.1.12.

25.3.1.2 Each escape webbing shall have the following compliance statement on the product label:

MEETS THE ESCAPE WEBBING REQUIREMENTS OF NFPA 1983, INCORPORATED IN THE 2022 EDITION OF NFPA 2500.

25.3.1.3* In addition to the compliance statement specified in 25.3.1.2, at least the following information shall be provided on the product label:

MINIMUM BREAKING STRENGTH: _____ kN

PERIMETER: _____ mm

Type of fiber(s) _____

25.3.1.4 The perimeter of the escape webbing, which is required in 25.3.1.3 to be stated on the product label, shall be as determined by the certification organization in accordance with 27.3.2.

25.3.1.5 In addition to the compliance statement specified in 25.3.1.3, each escape webbing shall also be marked for its full length by insertion of a continuous identification tape(s). At least the following statement and information shall be printed on the tape not less than every 1 m (39 in.):

[MEETS REQUIREMENTS FOR ESCAPE WEBBING OF NFPA 2500 (1983), 2022 ED.]

[Certification organization's label, symbol, or identifying mark]

[Name of manufacturer]

[Year and quarter of manufacture (not coded)]

25.3.1.6 The MBS value of the escape webbing, which is required in 25.3.1.3 to be stated on the product label, shall be permitted to be any value greater than the actual "pass" requirement value determined by the certification testing in accordance with 27.3.1, but shall not be greater than the calculated MBS.

25.3.2 Escape Webbing User Information.

25.3.2.1 The manufacturer of escape webbing that is certified as being compliant with this standard shall furnish the purchaser with at least use criteria, inspection procedures, cleaning procedures, maintenance procedures, and retirement criteria for the product.

25.3.2.2 The manufacturer shall provide information for the user regarding at least the following issues:

(1) Using the webbing only with a life safety harness or escape belt
(2) Inspecting the webbing periodically according to the manufacturers' inspection procedure
(3) Removing the webbing from service and destroying it if the webbing does not pass inspection or if there is any doubt about the safety or serviceability of the webbing
(4) Protecting the webbing from abrasion
(5) Not exposing the webbing to flame or high temperature and carrying the webbing where it will be protected as the webbing could melt or burn and fail if exposed to flame or high temperature
(6) Keeping the product label and user instructions/information after they are removed/separated from the webbing for future reference
(7) Referring to the user instructions/information before and after each use
(8) Cautioning that, if the instructions/information are not followed, the user could suffer serious consequences

25.3.2.3 The manufacturer shall provide information for the user that additional information regarding escape webbing can be found in NFPA 1500 and NFPA 1858 and NFPA 1983, incorporated in the 2022 edition of this standard.

25.3.2.4 The manufacturer of escape webbing that is certified as being compliant with this standard shall furnish the purchaser with a sample of suggested records to be maintained by the purchaser or user of escape webbing and a list of items that the records need to contain.

25.4 Fire Escape Rope.

25.4.1 Fire Escape Rope Label Requirements.

25.4.1.1* Each fire escape rope item shall have a product label.

25.4.1.2* Where fire escape rope is an integral and nonseparable piece of a manufactured system and that manufactured system is certified as compliant with this standard, the fire escape rope shall be required to have at least the continuous identification tape specified in 25.4.1.12.

25.4.1.3 The fire escape rope product label shall be permitted to be a hang tag affixed to each fire escape rope or shall be permitted to be printed on a sheet that is inserted and sealed in the packaging that immediately contains the fire escape rope.

25.4.1.4 All letters shall be at least 2.0 mm ($\frac{5}{64}$ in.) high.

25.4.1.5 All worded portions of the required product label shall be at least in English.

25.4.1.6 Symbols and other pictorial graphic representations shall be permitted to be used to supplement worded statements on the product label(s).

25.4.1.7 The certification organization's label, symbol, or identifying mark shall be printed on the product label. All letters shall be at least 2.5 mm ($\frac{3}{32}$ in.) high.

25.4.1.8 Each fire escape rope shall have the following compliance statement on the product label:

MEETS THE FIRE ESCAPE ROPE REQUIREMENTS OF NFPA 1983, INCORPORATED IN THE 2022 EDITION OF NFPA 2500.

25.4.1.9* In addition to the compliance statement specified in 25.4.1.8, at least the following information shall be provided on the product label:

MINIMUM BREAKING STRENGTH: _____ kN

DIAMETER: _____ mm

Type of fiber(s) _____

25.4.1.10 The MBS value of the fire escape rope, which is required in 25.4.1.9 to be stated on the product label, shall be permitted to be any value greater than the actual "pass" requirement value determined by the certification testing in accordance with 27.2.1, but shall not be greater than the calculated MBS.

25.4.1.11 The diameter of the fire escape rope, which is required in 25.4.1.9 to be stated on the product label, shall be as determined by the certification organization in accordance with 27.2.2.

25.4.1.12* In addition to the compliance statement specified in 25.4.1.8, each fire escape rope shall also be marked for its full length by insertion of a continuous identification tape(s). At least the following statement and information shall be printed on the tape not less than every 1 m (39 in.):

[MEETS REQUIREMENTS FOR FIRE ESCAPE ROPE OF NFPA 2500 (1983), 2022 ED.]

[Certification organization's label, symbol, or identifying mark]

[Name of manufacturer]

[Year and quarter of manufacture (not coded)]

25.4.1.13 In addition to the compliance and information statements in 25.4.1.8 and 25.4.1.9, at least the following information shall also be printed on the product label(s)where all letters shall be at least 2 mm ($\frac{5}{64}$ in.) high.

(1) Manufacturer's name, identification, or designation
(2) Manufacturer's address
(3) Country of manufacture
(4) Manufacturer's product identification
(5) Model, style, lot, or serial number
(6) Elongation at 1.35 kN (300 lb)
(7) Elongation at 2.7 kN (600 lb)
(8) Elongation at 4.4 kN (1000 lb)

25.4.2 Fire Escape Rope User Information.

25.4.2.1 The manufacturer of fire escape rope that is certified as being compliant with this standard shall furnish the purchaser with at least use criteria, inspection procedures, cleaning procedures, maintenance procedures, and retirement criteria for the product.

25.4.2.2 The manufacturer shall provide information for the user regarding at least the following issues:

(1) Using the rope only with a life safety harness or escape belt
(2) Inspecting the rope periodically according to the manufacturers' inspection procedure
(3) Removing the rope from service and destroying it if the rope does not pass inspection or if there is any doubt about the safety or serviceability of the rope
(4) Protecting the rope from abrasion
(5) Not exposing the rope to flame or high temperature and carrying the rope where it will be protected as the rope could melt or burn and fail if exposed to flame or high temperature
(6) Keeping the product label and user instructions/information after they are removed/separated from the rope for future reference
(7) Referring to the user instructions/information before and after each use
(8) Cautioning that, if the instructions/information are not followed, the user could suffer serious consequences

25.4.2.3 The manufacturer shall provide information for the user that additional information regarding fire escape rope can be found in NFPA 1500 and NFPA 1858 and NFPA 1983, incorporated in the 2022 edition of this standard.

25.4.2.4 The manufacturer of fire escape rope that is certified as being compliant with this standard shall furnish the purchaser with a sample of suggested records to be maintained by the purchaser or user of fire escape rope and a list of items that the records need to contain.

25.5 Fire Escape Webbing.

25.5.1 Fire Escape Webbing Label Requirements.

25.5.1.1 Fire escape webbing shall meet the labeling requirements in 25.2.1, escape rope, excluding 25.2.1.8, 25.2.1.9, 25.2.1.10, 25.2.1.11, and 25.2.1.12.

25.5.1.2 Each fire escape webbing shall have the following compliance statement on the product label:

MEETS THE FIRE ESCAPE WEBBING REQUIREMENTS OF NFPA 1983, INCORPORATED IN THE 2022 EDITION OF NFPA 2500.

25.5.1.3* In addition to the compliance statement specified in 25.5.1.2, at least the following information shall be provided on the product label:

MINIMUM BREAKING STRENGTH: _____ kN

PERIMETER: _____ mm

Type of fiber(s) _____

25.5.1.4 The perimeter of the fire escape webbing, which is required in 25.5.1.3 to be stated on the product label, shall be as determined by the certification organization in accordance with 27.5.2.

25.5.1.5 In addition to the compliance statement specified in 25.5.1.2, each fire escape webbing shall also be marked for its full length by insertion of a continuous identification tape(s). At least the following statement and information shall be legibly printed on the tape not less than every 1 m (39 in.):

[MEETS REQUIREMENTS FOR FIRE ESCAPE WEBBING OF NFPA 2500 (1983), 2022 ED.]

[Certification organization's label, symbol, or identifying mark]

[Name of manufacturer]

[Year and quarter of manufacture (not coded)]

25.5.1.6 The MBS value of the escape webbing, which is required in 25.5.1.3 to be stated on the product label, shall be permitted to be any value greater than the actual "pass" requirement value determined by the certification testing in accordance with 27.5.1, but shall not be greater than the calculated MBS.

25.5.2 Fire Escape Webbing User Information.

25.5.2.1 The manufacturer of fire escape webbing that is certified as being compliant with this standard shall furnish the purchaser with at least use criteria, inspection procedures, cleaning procedures, maintenance procedures, and retirement criteria for the product.

25.5.2.2 The manufacturer shall provide information for the user regarding at least the following issues:

(1) Using the webbing only with a life safety harness or escape belt
(2) Inspecting the webbing periodically according to the manufacturers' inspection procedure
(3) Removing the webbing from service and destroying it if the webbing does not pass inspection or if there is any doubt about the safety or serviceability of the webbing
(4) Protecting the webbing from abrasion
(5) Not exposing the webbing to flame or high temperature and carrying the webbing where it will be protected as the webbing could melt or burn and fail if exposed to flame or high temperature
(6) Keeping the product label and user instructions/information after they are removed/separated from the webbing for future reference
(7) Referring to the user instructions/information before and after each use
(8) Cautioning that, if the instructions/information are not followed, the user could suffer serious consequences

25.5.2.3 The manufacturer shall provide information for the user that additional information regarding fire escape webbing can be found in NFPA 1500 and NFPA 1858 and NFPA 1983, incorporated in the 2022 edition of this standard.

25.5.2.4 The manufacturer of fire escape webbing that is certified as being compliant with NFPA 1983 shall furnish the purchaser with a sample of suggested records to be maintained by the purchaser or user of fire escape webbing and a list of items that the records need to contain.

25.6 Throwlines.

25.6.1 Throwline Label Requirements.

25.6.1.1* Each throwline item shall have a product label.

25.6.1.2 Where a throwline is an integral and nonseparable piece of a manufactured system and that manufactured system is certified as compliant with NFPA 1983. The throwline shall be required to have at least the continuous identification tape specified in 25.6.1.12.

25.6.1.3 The throwline product label shall be permitted to be a hang tag affixed to each individual throwline or shall be permitted to be printed on a sheet that is inserted and sealed in the packaging that immediately contains the throwline.

25.6.1.4 All letters shall be at least 2 mm ($\frac{5}{64}$ in.) high.

25.6.1.5 All worded portions of the required product label shall at least be in English.

25.6.1.6 Symbols and other pictorial graphic representations shall be permitted to be used to supplement worded statements on the product label(s).

25.6.1.7 The certification organization's label, symbol, or identifying mark shall be printed on the product label. All letters shall be at least 2 mm ($\frac{5}{64}$ in.) high.

25.6.1.8* Each throwline shall have the following compliance statement on the product label:

MEETS THE THROWLINE REQUIREMENTS OF NFPA 1983, INCORPORATED IN THE 2022 EDITION OF NFPA 2500.

25.6.1.9 In addition to the compliance statement specified in 25.6.1.8, at least the following information shall be provided on the product label.

MINIMUM BREAKING STRENGTH: _____ kN

DIAMETER: _____ mm

Type of fiber(s) _____

25.6.1.10 The MBS value of the throwline, which is required in 25.6.1.9 to be stated on the product label, shall be permitted to be any value greater than the actual "pass" requirement value determined by the certification testing in accordance with 27.6.1, but shall not be greater than the calculated MBS.

25.6.1.11 The diameter of the throwline, which is required in 25.6.1.8 to be stated on the product label, shall be as determined by the certification organization in accordance with 27.6.2.

25.6.1.12 In addition to the compliance statement specified in 25.6.1.8, each throwline shall also be marked for its full length by insertion of a continuous identification tape(s). At least the following statement and information shall be printed on the tape not less than every 1 m (39 in.):

[MEETS REQUIREMENTS FOR THROWLINE OF NFPA 2500 (1983), 2022 ED.]

[Certification organization's label, symbol, or identifying mark]

[Name of manufacturer]

[Year and quarter of manufacture (not coded)]

25.6.1.13 In addition to the compliance and information statements in 25.6.1.8 and 25.6.1.9, at least the following information shall also be printed on the product label(s)where all letters shall be at least 2 mm ($\frac{5}{64}$ in.) high:

(1) Manufacturer's name, identification, or designation
(2) Manufacturer's address
(3) Country of manufacture
(4) Manufacturer's product identification
(5) Model, style, lot, or serial number

25.6.2 Throwline User Information. The manufacturer of a throwline that is certified as being compliant with this standard shall furnish the purchaser with at least use criteria, inspection procedures, cleaning procedures, maintenance procedures, and retirement criteria for the product.

25.6.2.1 The manufacturer shall provide information for the user that additional information regarding throwlines can be found in NFPA 1500 and NFPA 1858 and NFPA 1983, incorporated in the 2022 edition of this standard.

25.7 Moderate Elongation Laid Life-Saving Rope.

25.7.1 Moderate Elongation Laid Life-Saving Rope Label Requirements.

25.7.1.1 Each moderate elongation laid life-saving rope shall have a product label.

25.7.1.2 The moderate elongation laid life-saving rope product label shall be permitted to be a hang tag affixed to each rope or shall be permitted to be printed on a sheet that is inserted and sealed in the packaging that immediately contains the moderate elongation laid life-saving rope.

25.7.1.3 All letters shall be at least 2 mm ($\frac{5}{64}$ in.) high.

25.7.1.4 All worded portions of the required product label shall be at least in English.

25.7.1.5 Symbols and other pictorial graphic representations shall be permitted to be used to supplement worded statements on the product label(s).

25.7.1.6 The certification organization's label, symbol, or identifying mark shall be printed on the product label. All letters shall be at least 2.5 mm ($\frac{3}{32}$ in.) high.

25.7.1.7 Each moderate elongation laid life-saving rope shall have the following compliance statement on the product label:

MEETS THE MODERATE ELONGATION LAID LIFE-SAVING ROPE REQUIREMENTS OF NFPA 1983, INCORPORATED IN THE 2022 EDITION OF NFPA 2500.

25.7.1.8 In addition to the compliance statement specified in 25.7.1.7, at least the following information shall be provided on the product label:

MINIMUM BREAKING STRENGTH: ___kN

DIAMETER: ____mm

Type of Fiber(s):_____.

25.7.1.9 The MBS value of the moderate elongation laid life-saving rope, which is required in 25.7.1.8 to be stated on the product label, shall be permitted to be any value greater than the actual "pass" requirement value determined by the certification testing in accordance with 27.7.1, but shall not be greater than the calculated MBS.

25.7.1.10 The diameter of the moderate elongation laid life-saving rope, which is required in 25.7.1.8 to be stated on the product label, shall be as determined by the certification organization in accordance with 27.7.2.

25.7.1.11 In addition to the compliance statement specified in 25.7.1.7, each moderate elongation laid life-saving rope shall also be marked for its full length by insertion of a continuous identification tape(s). At least the following statement and information shall be printed on the tape not less than every 1 m (39 in.):

[MEETS REQUIREMENTS FOR MODERATE ELONGATION LAID LIFE-SAVING ROPE OF NFPA 2500 (1983), 2022 ED.]

[Certification organization's label, symbol, or identifying mark]

[Name of manufacturer]

[Year and quarter of manufacture (not coded)]

25.7.1.12 In addition to the compliance and information statements specified in 25.7.1.7, 25.7.1.8, and 25.7.1.11, at least the following information shall also be printed on the product label(s)where all letters shall be at least 2 mm ($\frac{5}{64}$ in.) high:

(1) Manufacturer's name, identification, or designation
(2) Manufacturer's address
(3) Country of manufacture
(4) Manufacturer's product identification
(5) Model, style, lot, or serial number
(6) Elongation at 1.35 kN (300 lbf)
(7) Elongation at 2.7 kN (600 lbf)
(8) Elongation at 4.4 kN (1000 lbf)

25.7.2 Moderate Elongation Laid Life-Saving Rope User Information.

25.7.2.1 The manufacturer of moderate elongation laid life-saving rope that is certified as being compliant with this standard shall furnish the purchaser with at least use criteria, inspection procedures, cleaning procedures, maintenance procedures, and retirement criteria for the product.

25.7.2.2 The manufacturer shall provide information for the user to consider prior to reusing moderate elongation laid life-saving rope, including that the rope be considered for reuse only if all of the following conditions are met:

(1) Rope has not been visually damaged.
(2) Rope has not been exposed to heat, direct flame impingement, or abrasion.
(3) Rope has not been subjected to any impact load.
(4) Rope has not been exposed to liquids, solids, gases, mists, or vapors of any chemical or other material that can deteriorate rope.
(5) Rope passes inspection when inspected by a qualified person following the manufacturer's inspection procedures both before and after each use.

25.7.2.3 The manufacturer shall provide information for the user regarding not using the moderate elongation laid life-saving rope and removing the rope from service if the rope does not meet all of the conditions in 25.7.2.2, if the rope does not pass inspection, or if there is any doubt about the safety or serviceability of the rope.

25.7.2.4 The manufacturer shall provide information for the user regarding at least the following issues:

(1) Inspecting the rope periodically according to the manufacturer's inspection procedure

(2) Removing the rope from service and destroying it if the rope does not pass inspection or if there is any doubt about the safety or serviceability of the rope
(3) Protecting the rope from abrasion
(4) Not exposing the rope to flame or high temperature and carrying the rope where it will be protected as the rope could melt or burn and fail if exposed to flame or high temperature
(5) Keeping the product label and user instructions/information after they are removed/separated from the rope and retaining them in the permanent rope record; copying the product label and user instructions/information and keeping the copies with the rope
(6) Referring to the user instructions/information before and after each use
(7) Cautioning that if the instructions/information are not followed, the user could suffer serious consequences

25.7.2.5 The manufacturer shall provide information for the user that additional information regarding moderate elongation laid life-saving rope can be found in NFPA 1500 and NFPA 1858 and NFPA 1983, incorporated in the 2022 edition of this standard.

25.7.2.6 The manufacturer of moderate elongation laid life-saving rope that is certified as being compliant with this standard shall furnish the purchaser with a sample of suggested records to be maintained by the purchaser or user of moderate elongation laid life-saving rope and a list of items that the records need to contain.

25.8 Manufacturer-Supplied Eye Termination.

25.8.1 Manufacturer-Supplied Eye Termination Label Requirements.

25.8.1.1 Each manufacturer-supplied eye termination shall have a product label.

25.8.1.2 The manufacturer-supplied eye termination product label shall be permitted to be a hang tag affixed to each manufacturer-supplied eye termination or shall be permitted to be printed on a sheet that is inserted and sealed in the packaging that immediately contains the manufacturer-supplied eye termination.

25.8.1.3 All letters shall be at least 2 mm ($\frac{5}{64}$ in.) high.

25.8.1.4 All worded portions of the required product label shall be at least in English.

25.8.1.5 Symbols and other pictorial graphic representations shall be permitted to be used to supplement worded statements on the product label(s).

25.8.1.6 The certification organization's label, symbol, or identifying mark shall be printed on the product label. All letters shall be at least 2.5 mm ($\frac{3}{32}$ in.) high.

25.8.1.7 Each manufacturer-supplied eye termination shall have the following compliance statement on the product label:

MEETS THE MANUFACTURER-SUPPLIED EYE TERMINATION REQUIREMENTS OF NFPA 1983, INCORPORATED IN THE 2022 EDITION OF NFPA 2500.

MBS: _____kN

25.8.1.8 In addition to the compliance statement specified in 25.8.1.7, at least the following information shall be provided on the product label:

THIS (ROPE OR ESCAPE WEBBING) IS CERTIFIED AS CLASS: _____ (ROPE OR WEBBING) WITH MBS OF ___kN

DIAMETER: _____mm

Type of Fibers: _____,

Thread Fiber: _____

25.8.1.9 In addition to the compliance and information statements in 25.8.1.7 and 25.8.1.8, at least the following information shall also be printed on the product label(s)where all letters shall be at least 2 mm ($\frac{5}{64}$ in.) high:

(1) Manufacturer's name, identification, or designation
(2) Manufacturer's address
(3) Country of manufacturer
(4) Manufacturer's product identification
(5) Model, style, lot, or serial number

25.8.1.10 Where the manufacturer of the life safety rope, escape rope, fire escape rope, or throwline and the manufacturer of the manufacturer-supplied eye termination are the same, the labeling for both the rope and manufacturer-supplied eye termination shall be permitted to be combined, as long as all required product label information of the rope and manufacturer-supplied eye termination as given in 25.8.1.1 through 25.8.1.9 is included on the label.

25.8.1.11 Where the manufacturer of the escape system, fire escape system, or manufactured system and the manufacturer of the manufacturer-supplied eye termination are the same, the labeling for both the system and manufacturer-supplied eye termination shall be permitted to be combined, as long as all required product label information of the system and manufacturer-supplied eye termination as given in 25.8.1.1 through 25.8.1.9 is included on the label.

25.8.1.12 Where the manufacturer of the escape webbing or fire escape webbing and the manufacturer of the manufacturer-supplied eye termination are the same, the labeling for both the webbing and the manufacturer-supplied eye termination shall be permitted to be combined, as long as all required product label information of the webbing and manufacturer-supplied eye termination as given in 25.8.1.1 through 25.8.1.9 is included on label.

25.8.2 Manufacturer-Supplied Eye Termination User Information.

25.8.2.1 The manufacturer of the manufacturer-supplied eye termination that is certified as being compliant with this standard shall furnish the purchaser with at least use criteria, inspection procedures, cleaning procedures, maintenance procedures, and retirement criteria for the product.

25.8.2.2 The manufacturer shall provide information for the user to consider prior to reusing manufacturer-supplied eye termination, including that the rope be considered for reuse only if all of the following conditions are met:

(1) Manufacturer-supplied eye termination has not been visually damaged.
(2) Manufacturer-supplied eye termination has not been exposed to heat, direct flame impingement, or abrasion.

(3) Manufacturer-supplied eye termination has not been subjected to any impact load.
(4) Manufacturer-supplied eye termination has not been exposed to liquids, solids, gases, mists, or vapors of any chemical or other material that can deteriorate the manufacturer-supplied eye termination.
(5) Manufacturer-supplied eye termination passes inspection when inspected by a qualified person following the manufacturer's inspection procedures both before and after each use.

25.8.2.3 The manufacturer shall provide information for the user regarding not using the manufacturer-supplied eye termination and removing the manufacturer-supplied eye termination from service if the rope does not meet all of the conditions in 25.8.2.2, if the manufacturer-supplied eye termination does not pass inspection, or if there is any doubt about the safety or serviceability of the manufacturer-supplied eye termination.

25.8.2.4 The manufacturer shall provide information for the user regarding at least the following issues:

(1) Inspecting the manufacturer-supplied eye termination periodically according to the manufacturer's inspection procedure
(2) Removing the manufacturer-supplied eye termination from service and destroying it if the manufacturer-supplied eye termination does not pass inspection or if there is any doubt about the safety of the manufacturer-supplied eye termination
(3) Protecting the manufacturer-supplied eye termination from abrasion
(4) Not exposing the manufacturer-supplied eye termination to flame or high temperature and carrying the manufacturer-supplied eye termination where it will be protected as the manufacturer-supplied eye termination could melt or burn and fail if exposed to flame or high temperature
(5) Keeping the product label and user instructions/information after they are removed/separated from the manufacturer-supplied eye termination and retaining them in the permanent manufacturer-supplied eye termination record; copying the product label and user information/instructions and keeping copies with the manufacturer-supplied eye termination
(6) Referring to the user instructions/information before and after each use
(7) Cautioning that, if the instructions/information are not followed, the user could suffer serious consequences

25.8.2.5 The manufacturer of manufacturer-supplied eye termination that is certified as being compliant with this standard shall furnish the purchaser with a sample of suggested records to be maintained by the purchaser or user of manufacturer-supplied eye termination and a list of items that the records need to contain.

25.8.2.5.1 The suggested inspection records shall include inspection of the loop of the eye, inspection for worn or broken thread in sewn termination, and inspection of contact point of swage and rope in swage termination.

25.8.2.6 Where the manufacturer of the life safety rope, escape rope, fire escape rope, or throwline and the manufacturer of the manufacturer-supplied eye termination are the same, the user information/instructions for both the rope and manufacturer-supplied eye termination shall be permitted to be combined, as long as all required user information/instructions of the rope and manufacturer-supplied eye termination as given in 25.8.2.1 through 25.8.2.5.1 are included in the user information/instructions.

25.8.2.7 Where the manufacturer of the escape webbing or fire escape webbing and the manufacturer of the manufacturer-supplied eye termination are the same, the user information/instructions for both the webbing and manufacturer-supplied eye termination shall be permitted to be combined, as long as all required user information/instructions of the webbing and manufacturer-supplied eye termination as given in 25.8.2.1 through 25.8.2.5.1 are included in the user information/instructions.

25.8.2.8 Where the manufacturer of the escape system, fire escape system, or manufactured system and the manufacturer of the manufacturer-supplied eye termination are the same, the user information/instructions for both the system and manufacturer-supplied eye termination shall be permitted to be combined, as long as all required user information/instructions of the system and manufacturer-supplied eye termination as given in 25.8.2.1 through 25.8.2.5.1 are included in the user information/instructions.

25.8.2.9 The manufacturer shall provide information for the user that additional information regarding manufacturer-supplied eye termination can be found in NFPA 1500 and NFPA 1858 and NFPA 1983, incorporated in the 2022 edition of this standard.

25.9 Life Safety Harnesses.

25.9.1 Life Safety Harness Label Requirements.

25.9.1.1 Each life safety harness item shall have a product label.

25.9.1.2 Harnesses used in manufactured systems shall be required to be individually labeled.

25.9.1.3 Harness product labels shall be embossed, printed, sewn, stapled, riveted, or otherwise permanently attached to the harness.

25.9.1.4 Harness product labels shall be located on each harness when the harness is properly assembled with all components in place.

25.9.1.5 All letters shall be at least 2 mm ($\frac{5}{64}$ in.) high.

25.9.1.6 Multi-label pieces shall be permitted to carry all statements and information required to be on the product label; however, all label pieces comprising the entire product label shall be located adjacent to each other.

25.9.1.7 All worded portions of the required product label shall at least be in English.

25.9.1.8 Symbols and other pictorial graphic representations shall be permitted to be used to supplement worded statements on the product label(s).

25.9.1.9 The certification organization's label, symbol, or identifying mark shall be printed on the product label. All letters shall be at least 2.5 mm ($\frac{3}{32}$ in.) high.

25.9.1.10 Where the life safety harness is certified as compliant with only the nonoptional requirements of the standard and is not certified with the optional flame resistance require-

ments, the following statement shall be printed legibly on the product label:

MEETS THE LIFE SAFETY HARNESS REQUIREMENTS OF NFPA 1983, INCORPORATED IN THE 2022 EDITION OF NFPA 2500, CLASS _____. THIS HARNESS IS NOT FLAME-RESISTANT!

DO NOT REMOVE THIS LABEL!

25.9.1.11 Where the life safety harness is certified as compliant with nonoptional requirements of this standard and also certified as compliant with the optional flame resistance requirements specified in 26.9.2, and 27.9.6, the following statement shall be printed on the product label:

MEETS THE LIFE SAFETY HARNESS REQUIREMENTS OF NFPA 1983, INCORPORATED IN THE 2022 EDITION OF NFPA 2500, AND THE OPTIONAL FLAME RESISTANCE REQUIREMENTS OF NFPA 1983, CLASS _____.

DO NOT REMOVE THIS LABEL!

25.9.1.12* In addition to the compliance statement specified in 25.9.1.10 or 25.9.1.11, at least the following information shall be provided on the product label:

(1) For Class II harness: **Fits waist size _____**
(2) For one-piece Class III harness: **Fits waist size _____, Fits height _____** or **Fits chest size _____, Fits height _____**
(3) For multiple-piece Class III harness: **Fits waist size _____, Fits height _____** or **Fits chest size _____, Fits height _____**

This is one part of a multi-piece harness and must be used in conjunction with component part number ___ to fully meet the criteria of Class ___ harness.

25.9.1.13 The class designation of the life safety harness required to be stated on the product label(s) shall be as determined by the certification organization in accordance with 26.9.1.

25.9.1.14 In addition to the compliance and information statements in 25.9.1.10, 25.9.1.12, and 25.9.1.15, at least the following information shall also be printed on the product label(s) where all letters shall be at least 2 mm ($\frac{5}{64}$ in.) high:

(1) Manufacturer's name, identification, or designation
(2) Manufacturer's address
(3) Country of manufacture
(4) Manufacturer's product identification
(5) Model, style, lot, or serial number

25.9.1.15 Where detachable components must be used with a life safety harness for the life safety harness to be compliant with this standard, at least the following statement and information shall also be printed on the product label of the life safety harness. All letters shall be at least 2.5 mm ($\frac{3}{32}$ in.) high. The detachable component(s) shall be listed following the statement by type, identification, and how properly used.

TO BE COMPLIANT WITH NFPA 1983, INCORPORATED IN THE 2022 EDITION OF NFPA 2500, THE FOLLOWING ADDITIONAL COMPONENTS MUST BE USED IN CONJUNCTION WITH THIS LIFE SAFETY HARNESS: [The detachable component(s) shall be listed here.]

25.9.2 Life Safety Harness User Information.

25.9.2.1 The manufacturer of life safety harnesses that are certified as being compliant with this standard shall furnish the purchaser with at least use criteria, inspection procedures, cleaning procedures, maintenance procedures, and retirement criteria for the product.

25.9.2.2 The manufacturer shall provide information for the user regarding at least the following issues:

(1) Inspecting the harness periodically according to the manufacturer's inspection procedure
(2) Removing the harness from service and destroying it if the harness does not pass inspection or if there is any doubt about the safety or serviceability of the harness
(3) For a life safety harness certified to only the nonoptional requirements of the standard, not exposing the harness to flame or high temperature and carrying the harness where it will be protected, as the harness could melt or burn and fail if exposed to flame or high temperature
(4) Maintaining the harness in accordance with the manufacturer's instructions where metal components are subject to corrosion or deterioration
(5) Repairing the harness only in accordance with the manufacturer's instructions
(6) Keeping the user instructions/information after they are separated from the harness and retaining them in a permanent record; copying the user instructions/information and keeping the copy with the harness
(7) Referring to the user instructions/information before and after each use
(8) Cautioning that, if the instructions/information are not followed, the user could suffer serious consequences

25.9.2.3 The manufacturer shall provide information for the user that additional information regarding life safety harnesses can be found in NFPA 1500 and NFPA 1858 and NFPA 1983, incorporated in the 2022 edition of this standard.

25.9.2.4 The manufacturer of life safety harnesses that are certified as being compliant with this standard shall furnish the purchaser with a sample of suggested records to be maintained by the purchaser or user of life safety harnesses and a list of items that the records need to contain.

25.9.2.5 The manufacturer of life safety harnesses that are certified as being compliant with this standard shall indicate that tie-off is required for webbing ends if tie-off of webbing end(s) was required during testing. The instructions shall include location(s) and method(s) with text and/or illustrations.

25.10 Belts.

25.10.1 Belt Label Requirements.

25.10.1.1 Each belt item shall have a product label.

25.10.1.2 Belts used in manufactured systems shall be required to be individually labeled.

25.10.1.3 Belt product labels shall be embossed, printed, sewn, stapled, riveted, or otherwise permanently attached to the belt.

25.10.1.4 Belt product labels shall be located on each belt when the belt is properly assembled with all components in place.

25.10.1.5 All letters shall be at least 2 mm (5/64 in.) high.

25.10.1.6 Multi-label pieces shall be permitted to carry all statements and information required to be on the product label; however, all label pieces comprising the entire product label shall be located adjacent to each other.

25.10.1.7 All worded portions of the required product label shall at least be in English.

25.10.1.8 Symbols and other pictorial graphic representations shall be permitted to be used to supplement worded statements on the product label(s).

25.10.1.9 The certification organization's label, symbol, or identifying mark shall be printed on the product label. All letters shall be at least 2.5 mm (3/32 in.) high.

25.10.1.10 Where the belt is certified as compliant with only the nonoptional requirements of the standard and is not certified with the optional flame resistance requirements, the following statement shall be printed on the product label:

MEETS THE BELT REQUIREMENTS OF NFPA 1983, INCORPORATED IN THE 2022 EDITION OF NFPA 2500, TYPE _____. THIS BELT IS NOT FLAME-RESISTANT! DO NOT REMOVE THIS LABEL!

25.10.1.11 Where the belt is certified as compliant with nonoptional requirements of this standard and also certified as compliant with the optional flame resistance requirements specified in 26.10.2 and 27.10.7, the following statement shall be printed on the product label:

MEETS THE BELT REQUIREMENTS OF NFPA 1983, INCORPORATED IN THE 2022 EDITION OF NFPA 2500, AND THE OPTIONAL FLAME RESISTANCE REQUIREMENTS OF NFPA 1983, TYPE _____.

DO NOT REMOVE THIS LABEL!

25.10.1.12 In addition to the compliance statement specified in 25.10.1.10 or 25.10.1.11, at least the following information shall be provided on the product label:

Fits waist size _____

25.10.1.13 The type designation of belt required to be stated on the product label shall be as determined by the certification organization in accordance with 26.10.1.

25.10.1.14 In addition to the compliance and information statements in 25.10.1.10 or 25.10.1.11, 25.10.1.12, and 25.10.1.15, at least the following information shall also be printed legibly on the product label(s)where all letters shall be at least 2 mm (5/64 in.) high.

(1) Manufacturer's name, identification, or designation
(2) Manufacturer's address
(3) Country of manufacture
(4) Manufacturer's product identification
(5) Model, style, lot, or serial number

25.10.1.15 Where detachable components must be used with the belt for the belt to be compliant with this standard, at least the following statement and information shall also be printed on the product label of the belt. All letters shall be at least 2.5 mm (3/32 in.) high. The detachable component(s) shall be listed following the statement by type, identification, and how properly used:

TO BE COMPLIANT WITH NFPA 1983, INCORPORATED IN THE 2022 EDITION OF NFPA 2500, THE FOLLOWING ADDITIONAL COMPONENTS MUST BE USED IN CONJUNCTION WITH THIS BELT: [The detachable component(s) shall be listed here.]

25.10.2 Belt User Information.

25.10.2.1 The manufacturer of belts that are certified as being compliant with this standard shall furnish the purchaser with at least use criteria, inspection procedures, cleaning procedures, maintenance procedures, and retirement criteria for the product.

25.10.2.2 The manufacturer shall provide information for the user regarding at least the following issues:

(1) Inspecting the belt periodically according to the manufacturer's inspection procedure
(2) Removing the belt from service and destroying it if the belt does not pass inspection or if there is any doubt about the safety or serviceability of the belt
(3) For belts certified to only the nonoptional requirements of the standard, not exposing the belt to flame or high temperature and carrying the belt where it will be protected, as the belt could melt or burn and fail if exposed to flame or high temperature
(4) Repairing the belt only in accordance with the manufacturer's instructions
(5) Keeping the user instructions/information after they are separated from the belt and retaining them in a permanent record; copying the user instructions/information and keeping the copy with the belt
(6) Referring to the user instructions/information before and after each use
(7) Cautioning that, if the instructions/information are not followed, the user could suffer serious consequences

25.10.2.3 The manufacturer shall provide information for the user that additional information regarding belts can be found in NFPA 1500 and NFPA 1858 and NFPA 1983, incorporated in the 2022 edition of this standard.

25.10.2.4 The manufacturer of belts that are certified as being compliant with this standard shall furnish the purchaser with a sample of suggested records to be maintained by the purchaser or user of belts and a list of items that the records need to contain.

25.10.2.5 The manufacturer of belts that are certified as being compliant with this standard shall indicate that tie-off of webbing end(s) is required for webbing end(s) if tie-off of webbing end(s) was required during testing. The instructions shall include location(s) and method(s) with text and/or illustrations.

25.11 Victim Extrication Devices.

25.11.1 Victim Extrication Device Label Requirements.

25.11.1.1 Each victim extrication device shall have a product label.

25.11.1.2 Each victim extrication device shall have a product label stamped, engraved, or otherwise permanently marked with the portions of the product label information.

25.11.1.2.1 Each victim extrication device shall display the mark or logo of the certification organization and the manufacturer's name or identifying mark.

25.11.1.3 All letters shall be at least 2 mm (5⁄64 in.) high.

25.11.1.4 Multi-label pieces shall be permitted to carry all statements and information required to be on the product label; however, all label pieces comprising the entire product label shall be located adjacent to each other.

25.11.1.5 All worded portions of the required product label shall be at least in English.

25.11.1.6 Symbols and other pictorial graphic representations shall be permitted to be used to supplement worded statements on the product label(s).

25.11.1.7 The certification organization's label, symbol, or identifying mark shall be printed on the product label. All letters shall be at least 2 mm (5⁄64 in.) high.

25.11.1.8 Each victim extrication device shall have the following compliance statement on the product label:

MEETS THE VICTIM EXTRICATION DEVICE REQUIREMENTS OF NFPA 1983, INCORPORATED IN THE 2022 EDITION OF NFPA 2500, CLASS _____.

25.11.1.9 In addition to the compliance and information statements in 25.11.1.8, at least the following information shall also be printed on the product label(s)where all letters shall be at least 2 mm (5⁄64 in.) high.

(1) Manufacturer's name, identification, or designation
(2) Manufacturer's address
(3) Country of manufacture
(4) Manufacturer's product identification
(5) Model, style, lot, or serial number

25.11.1.10 Where detachable components must be used with a victim extrication device for the device to be compliant with this standard, at least the following statement and information shall also be printed on the product label of the device. All labels shall be at least 2 mm (5⁄64 in.) high. The detachable components shall be listed following the statement by type, identification, and how properly used.

TO BE COMPLIANT WITH NFPA 1983, INCORPORATED IN THE 2022 EDITION OF NFPA 2500, THE FOLLOWING ADDITIONAL COMPONENTS MUST BE USED IN CONJUNCTION WITH THIS VICTIM EXTRICATION DEVICE: [The detachable component(s) shall be listed here.]

25.11.2 Victim Extrication Device User Information.

25.11.2.1 The manufacturer of the victim extrication device that is certified as being compliant with this standard shall furnish the purchaser with at least use criteria, inspection procedures, cleaning procedures, maintenance procedures, and retirement criteria for the product.

25.11.2.2 The manufacturer shall provide information for the user regarding at least the following issues:

(1) Inspecting the victim extrication device periodically according to the manufacturer's inspection procedure
(2) Removing the victim extrication device from service if the equipment does not pass inspection or if there is any doubt about the safety or serviceability of the equipment
(3) Maintaining the victim extrication device in accordance with the manufacturer's instructions where metal components are subjected to corrosion or deterioration
(4) Not exposing any software component of the victim extrication device to flame or high temperature and carrying the equipment where it will be protected as it could melt or burn and fail if exposed to flame or high temperature
(5) Repairing the victim extrication device only in accordance with the manufacturer's instructions
(6) Keeping the user instructions/information after they are separated from the victim extrication device and retaining them in a permanent record; copying the user instructions/information and keeping the copy with the equipment
(7) Referring to the user instructions/information before and after each use
(8) Cautioning that, if the instructions/information are not followed, the user could suffer serious consequences

25.11.2.3 The manufacturer of a victim extrication device that is certified as being compliant with this standard shall furnish the purchaser with a sample of suggested records to be maintained by the purchaser or user of the victim extrication device and a list of items that the records need to contain.

25.11.2.4 The manufacturer shall provide information for the user that additional information regarding victim extrication devices can be found in NFPA 1500 and NFPA 1858 and NFPA 1983, incorporated in the 2022 edition of this standard.

25.12 End-to-End Straps.

25.12.1 End-to-End Strap Label Requirements.

25.12.1.1 Each end-to-end strap shall have a product label.

25.12.1.2 End-to-end strap labels shall be embossed, printed, sewn, stapled, riveted, or otherwise permanently attached to the strap.

25.12.1.3 End-to-end strap labels shall be located on each strap when the strap is properly assembled with all components in place.

25.12.1.4 All letters shall be at least 2 mm (5⁄64 in.) high.

25.12.1.5 Multi-label pieces shall be permitted to carry all statements and information required to be on the product label; however, all label pieces comprising the entire product label shall be located adjacent to each other.

25.12.1.6 All worded portions of the required product label shall at least be in English.

25.12.1.7 Symbols and other pictorial graphic representations shall be permitted to be used to supplement worded statements on the product label(s).

25.12.1.8 The certification organization's label, symbol, or identifying mark shall be printed on the product label. All letters shall be at least 2 mm (5⁄64 in.) high.

25.12.1.9 End-to-end strap labels shall display a "G" for general use and "T" for technical use. The designation "G" or "T" shall be designated in accordance with 26.12.1.

25.12.1.10 Each end-to-end strap shall have the following compliance statement on the product label:

MEETS THE END-TO-END STRAP REQUIREMENTS OF NFPA 1983, INCORPORATED IN THE 2022 EDITION OF NFPA 2500.

25.12.1.11 In addition to the compliance statement specified in 25.12.1.10, the following information shall be provided on the product label:

MINIMUM BREAKING STRENGTH OF _____ kN WHEN PULLED END TO END.

25.12.1.12 In addition to the compliance and information statements in 25.12.1.9, 25.12.1.10, and 25.12.1.11, at least the following information shall also be printed on the product label(s) where all letters shall be at least 2 mm (5⁄64 in.) high:

(1) Manufacturer's name, identification, or designation
(2) Manufacturer's address
(3) Country of manufacture
(4) Manufacturer's product identification
(5) Model, style, lot, or serial number

25.12.2 End-to-End Strap User Information.

25.12.2.1 The manufacturer of end-to-end straps that are certified as being compliant with this standard shall furnish the purchaser with at least use criteria, inspection procedures, cleaning procedures, maintenance procedures, and retirement criteria for the product.

25.12.2.2 The manufacturer shall provide information for the user regarding at least the following issues:

(1) Inspecting the strap periodically according to the manufacturer's inspection procedure
(2) Removing the strap from service if the equipment does not pass inspection or if there is any doubt about the safety or serviceability of the strap
(3) Maintaining the strap in accordance with the manufacturer's instructions where metal components are subjected to corrosion or deterioration
(4) Returning the straps to the manufacturer or to a qualified inspection person/center if the strap is dropped or impact-loaded
(5) Not exposing the strap to flame or high temperature and carrying the strap where it will be protected as it could melt or burn and fail if exposed to flame or high temperature
(6) Repairing the strap only in accordance with the manufacturer's instructions
(7) Keeping the user instructions/information after they are separated from the strap and retaining them in a permanent record; copying the user instructions/information and keeping the copy with the strap
(8) Referring to the user instructions/information before and after each use
(9) Cautioning that, if the instructions/information are not followed, the user could suffer serious consequences

25.12.2.3 The manufacturer shall provide information for the user that additional information regarding end-to-end straps can be found in NFPA 1500 and NFPA 1858 and NFPA 1983, incorporated in the 2022 edition of this standard.

25.12.2.4 The manufacturer of end-to-end straps that are certified as being compliant with this standard shall furnish the purchaser with a sample of suggested records to be maintained by the purchaser or user of the strap and a list of items that the records need to contain.

25.13 Multiple Configuration Straps.

25.13.1 Multiple Configuration Strap Label Requirements.

25.13.1.1 Each multiple configuration strap shall have a product label.

25.13.1.2 Multiple configuration strap labels shall be embossed, printed, sewn, stapled, riveted, or otherwise permanently attached to the strap.

25.13.1.3 Multiple configuration strap labels shall be located on each strap when the strap is properly assembled with all components in place.

25.13.1.4 All letters shall be at least 2 mm (5⁄64 in.) high.

25.13.1.5 Multi-label pieces shall be permitted to carry all statements and information required to be on the product label; however, all label pieces that constitute the entire product label shall be located adjacent to each other.

25.13.1.6 All worded portions of the required product label shall at least be in English.

25.13.1.7 Symbols and other pictorial graphic representations shall be permitted to be used to supplement worded statements on the product label(s).

25.13.1.8 The certification organization's label, symbol, or identifying mark shall be printed on the product label. All letters shall be at least 2 mm (5⁄64 in.) high.

25.13.1.9 Multiple configuration labels shall display a "G" for general use and "T" for technical use. The designation "G" or "T" shall be designated in accordance with 26.13.1.

25.13.1.10 Each multiple configuration strap shall have the following compliance statement on the product label:

MEETS THE MULTIPLE CONFIGURATION STRAP REQUIREMENTS OF NFPA 1983, INCORPORATED IN THE 2022 EDITION OF NFPA 2500.

25.13.1.11 In addition to the compliance statement specified in 25.13.1.10, the following information shall be provided on the product label:

MINIMUM BREAKING STRENGTH OF _____ kN.

MBS AND RATING ARE DETERMINED USING A BASKET (U) CONFIGURATION. IN ADDITION, THIS STRAP HAS A MINIMUM BREAKING STRENGTH OF

_____ kN IN A CHOKER CONFIGURATION

_____ kN WHEN PULLED END TO END.

25.13.1.12 In addition to the compliance and information statements in 25.13.1.9, 25.13.1.10, and 25.13.1.11, at least the following information shall also be printed on the product label(s) where all letters shall be at least 2 mm (5⁄64 in.) high:

(1) Manufacturer's name, identification, or designation
(2) Manufacturer's address
(3) Country of manufacture
(4) Manufacturer's product identification
(5) Model, style, lot, or serial number

25.13.2 Multiple Configuration Strap User Information.

25.13.2.1 The manufacturer of multiple configuration straps that are certified as being compliant with this standard shall furnish the purchaser with at least use criteria, inspection procedures, cleaning procedures, maintenance procedures, and retirement criteria for the product.

25.13.2.2 The manufacturer shall provide information for the user regarding at least the following issues:

(1) Inspecting the strap periodically according to the manufacturer's inspection procedure
(2) Removing the strap from service if the equipment does not pass inspection or if there is any doubt about the safety or serviceability of the strap
(3) Maintaining the strap in accordance with the manufacturer's instructions where metal components are subjected to corrosion or deterioration
(4) Returning the straps to the manufacturer or to a qualified inspection person/center if the strap is dropped or impact-loaded
(5) Not exposing the strap to flame or high temperature and carrying the strap where it will be protected as it could melt or burn and fail if exposed to flame or high temperature
(6) Repairing the strap only in accordance with the manufacturer's instructions
(7) Keeping the user instructions/information after they are separated from the strap and retaining them in a permanent record; copying the user instructions/information and keeping the copy with the strap
(8) Referring to the user instructions/information before and after each use
(9) Cautioning that, if the instructions/information are not followed, the user could suffer serious consequences

25.13.2.3 The manufacturer shall provide information for the user that additional information regarding multiple configuration straps can be found in NFPA 1500 and NFPA 1858 and NFPA 1983, incorporated in the 2022 edition of this standard.

25.13.2.4 The manufacturer of multiple configuration straps that are certified as being compliant with this standard shall furnish the purchaser with a sample of suggested records to be maintained by the purchaser or user of the strap and a list of items that the records need to contain.

25.14 Belay Devices.

25.14.1 Belay Device Label Requirements.

25.14.1.1 Each belay device shall have a product label.

25.14.1.2 Each belay device shall have a product label stamped, engraved, or otherwise permanently marked with the portions of the product label information specified in 25.14.1.2.1 through 25.14.1.2.4.

25.14.1.2.1 Each belay shall have the following compliance statement:

[NFPA 2500 (1983), 2022 ED.]

25.14.1.2.2 Each belay device shall display the mark or logo of the certification organization and the manufacturer's name or identifying mark.

25.14.1.2.3 Each belay device shall display a "G" for general use or "T" for technical use. The designation "G" or "T" shall be designated in accordance with 26.14.1.2.

25.14.1.2.4 Each belay device shall display the range of rope diameters with which the device is intended to be used.

25.14.1.3 For the portions of the product label information not specified in 25.14.1.2.1 through 25.14.1.2.4, the product label shall be permitted to be a hang tag affixed to each individual belay device or shall be permitted to be printed on a sheet that is inserted and sealed in the packaging that immediately contains the belay device.

25.14.1.4 All letters shall be at least 2 mm (5⁄64 in.) high.

25.14.1.5 Multi-label pieces shall be permitted to carry all statements and information required to be on the product label; however, all label pieces comprising the entire product label shall be located adjacent to each other.

25.14.1.6 All worded portions of the required product label shall at least be in English.

25.14.1.7 Symbols and other pictorial graphic representations shall be permitted to be used to supplement worded statements on the product label(s).

25.14.1.8 The certification organization's label, symbol, or identifying mark shall be printed on the product label. All letters shall be at least 2 mm (5⁄64 in.) high.

25.14.1.9 Each belay device shall have the following compliance statement on the product label:

MEETS THE BELAY DEVICE REQUIREMENTS OF NFPA 1983, INCORPORATED IN THE 2022 EDITION OF NFPA 2500.

25.14.1.10 In addition to the compliance statement specified in 25.14.1.9, at least the information required in 25.14.1.2.3 and 25.14.1.2.4 shall also be provided on the printed product label.

25.14.1.11 In addition to the compliance and information statements in 25.14.1.9 and 25.14.1.10, at least the following information shall also be printed on the product label(s) where all letters shall be at least 2 mm (5⁄64 in.) high:

(1) Manufacturer's name, identification, or designation
(2) Manufacturer's address
(3) Country of manufacture
(4) Manufacturer's product identification
(5) Model, style, lot, or serial number

25.14.2 Belay Device User Information.

25.14.2.1 The manufacturer of belay device that is certified as being compliant with this standard shall furnish the purchaser with at least use criteria, inspection procedures, cleaning procedures, maintenance procedures, and retirement criteria for the product.

25.14.2.2 The manufacturer shall provide information for the user regarding at least the following issues:

(1) Inspecting the belay device periodically according to the manufacturer's inspection procedure
(2) Removing the belay device from service if the equipment does not pass inspection or if there is any doubt about the safety or serviceability of the equipment

(3) Maintaining the belay device in accordance with the manufacturer's instructions where metal components are subjected to corrosion or deterioration
(4) Returning the belay device to the manufacturer or to a qualified inspection person/center if the equipment is dropped or impact- loaded
(5) Repairing the belay device only in accordance with the manufacturer's instructions
(6) Keeping the user instructions/information after they are separated from the belay device and retaining them in a permanent record; copying the user instructions/information and keeping the copy with the equipment
(7) Referring to the user instructions/information before and after each use
(8) Cautioning that, if the instructions/information are not followed, the user could suffer serious consequences

25.14.2.3 The manufacturer shall provide information for the user that additional information regarding auxiliary equipment can be found in NFPA 1500 and NFPA 1858 and NFPA 1983, incorporated in the 2022 edition of this standard.

25.14.2.4 The manufacturer of a belay device that is certified as being compliant with this standard shall furnish the purchaser with a sample of suggested records to be maintained by the purchaser or user of the belay device and a list of items that the records need to contain.

25.14.2.5 Because belay is tested with a rope, the following statement shall be provided in the user instructions:

THIS BELAY DEVICE HAS PASSED THE MANNER OF FUNCTION TEST USING THE FOLLOWING ROPE: [insert rope manufacturer name, designation, part number, and diameter here].

25.14.2.6 Where the auxiliary equipment has been tested with multiple ropes, each rope shall be listed in the user instructions.

25.15 Carabiners and Snap Links.

25.15.1 Carabiners and Snap Link Label Requirements.

25.15.1.1 Each carabiner and snap link shall have a product label.

25.15.1.2 Each carabiner and snap link shall have a product label stamped, engraved, or otherwise permanently marked with the portions of the product label information specified in 25.15.1.2.1 through 25.15.1.2.4.

25.15.1.2.1 Each carabiner and snap link shall have the following compliance statement:

[NFPA 2500 (1983), 2022 ED.]

25.15.1.2.2 Each carabiner and snap link shall display the mark or logo of the certification organization and the manufacturer's name or identifying mark.

25.15.1.2.3 Each carabiner and snap link shall display at least the minimum rated breaking strength prefaced by the letters "MBS." The MBS value stated on the product label shall be permitted to be any value greater than the actual "pass" requirement value determined by the certification testing, but shall not be greater than the calculated MBS.

25.15.1.2.4 Each carabiner and snap link shall display a "G" for general-use items or a "T" for technical-use items. The designation "G" or "T" shall be designated in accordance with 26.15.1.2.

25.15.1.3 For the portions of the product label information not specified in 25.15.1.2.1 through 25.15.1.2.4, the product label shall be permitted to be a hang tag affixed to each individual carabiner and snap link or shall be permitted to be printed on a sheet that is inserted and sealed in the packaging that immediately contains the carabiner and snap link.

25.15.1.4 All letters shall be at least 2 mm (5⁄64 in.) high.

25.15.1.5 Multi-label pieces shall be permitted to carry all statements and information required to be on the product label; however, all label pieces comprising the entire product label shall be located adjacent to each other.

25.15.1.6 All worded portions of the required product label shall at least be in English.

25.15.1.7 Symbols and other pictorial graphic representations shall be permitted to be used to supplement worded statements on the product label(s).

25.15.1.8 The certification organization's label, symbol, or identifying mark shall be printed on the product label. All letters shall be at least 2 mm (5⁄64 in.) high.

25.15.1.9 Each carabiner and snap link shall have the following compliance statement on the product label:

MEETS THE [insert CARABINER OR SNAP LINK here] REQUIREMENTS OF NFPA 1983, INCORPORATED IN THE 2022 EDITION OF NFPA 2500.

25.15.1.10 In addition to the compliance statement specified in 25.15.1.9, at least the information required in 25.15.1.2.3 and 25.15.1.2.4 shall also be provided on the printed product label.

25.15.1.11 In addition to the compliance and information statements in 25.15.1.9 and 25.15.1.10, at least the following information shall also be printed on the product label(s) where all letters shall be at least 2 mm (5⁄64 in.) high:

(1) Manufacturer's name, identification, or designation
(2) Manufacturer's address
(3) Country of manufacture
(4) Manufacturer's product identification
(5) Model, style, lot, or serial number

25.15.2 Carabiner and Snap Link User Information.

25.15.2.1 The manufacturer of a carabiner and snap link that is certified as being compliant with this standard shall furnish the purchaser with at least use criteria, inspection procedures, cleaning procedures, maintenance procedures, and retirement criteria for the product.

25.15.2.2 The manufacturer shall provide information for the user regarding at least the following issues:

(1) Inspecting the carabiner or snap link periodically according to the manufacturer's inspection procedure
(2) Removing the carabiner or snap link from service if the equipment does not pass inspection or if there is any doubt about the safety or serviceability of the equipment
(3) Maintaining the carabiner or snap link in accordance with the manufacturer's instructions where metal components are subjected to corrosion or deterioration

(4) Returning the carabiner or snap link to the manufacturer or to a qualified inspection person/center if the equipment is dropped or impact-loaded
(5) Repairing the carabiner or snap-link only in accordance with the manufacturer's instructions
(6) Keeping the user instructions/information after they are separated from the carabiner or snap link and retaining them in a permanent record; copying the user instructions/information and keeping the copy with the equipment
(7) Referring to the user instructions/information before and after each use
(8) Cautioning that, if the instructions/information are not followed, the user could suffer serious consequences

25.15.2.3 The manufacturer shall provide information for the user that additional information regarding carabiners and snap links can be found in NFPA 1500 and NFPA 1858 and NFPA 1983, incorporated in the 2022 edition of this standard.

25.15.2.4 The manufacturer of a carabiner or snap-link that is certified as being compliant with this standard shall furnish the purchaser with a sample of suggested records to be maintained by the purchaser or user of the carabiner or snap-link and a list of items that the records need to contain.

25.16 Descent Control Devices.

25.16.1 Descent Control Device Label Requirements.

25.16.1.1 Each descent control device shall have a product label.

25.16.1.2 Each descent control device shall have a product label stamped, engraved, or otherwise permanently marked with the portions of the product label information specified in 25.16.1.2.1 through 25.16.1.2.4.

25.16.1.2.1 Each descent control device shall have the following compliance statement:

[NFPA 2500 (1983), 2022 ED.]

25.16.1.2.2 Each descent control device shall display the mark or logo of the certification organization and the manufacturer's name or identifying mark.

25.16.1.2.3 Each descent control device shall display a "G" for general-use items, a "T" for technical-use items, or an "E" for escape-use items. The designation "G," "T," or "E" shall be designated in accordance with 26.16.1.2.

25.16.1.2.4 Each descent control device shall display the range of rope diameters with which the device is intended to be used.

25.16.1.3 For the portions of the product label information not specified in 25.16.1.2.1 through 25.16.1.2.4, the product label shall be permitted to be a hang tag affixed to each individual descent control device or shall be permitted to be printed on a sheet that is inserted and sealed in the packaging that immediately contains the descent control device.

25.16.1.4 All letters shall be at least 2 mm (5⁄64 in.) high.

25.16.1.5 Multi-label pieces shall be permitted to carry all statements and information required to be on the product label; however, all label pieces comprising the entire product label shall be located adjacent to each other.

25.16.1.6 All worded portions of the required product label shall at least be in English.

25.16.1.7 Symbols and other pictorial graphic representations shall be permitted to be used to supplement worded statements on the product label(s).

25.16.1.8 The certification organization's label, symbol, or identifying mark shall be printed on the product label. All letters shall be at least 2 mm (5⁄64 in.) high.

25.16.1.9 Each descent control device shall have the following compliance statement on the product label:

MEETS THE DESCENT CONTROL DEVICE REQUIREMENTS OF NFPA 1983, INCORPORATED IN THE 2022 EDITION OF NFPA 2500.

25.16.1.10 In addition to the compliance statement specified in 25.16.1.9, at least the information required in 25.16.1.2.3 through 25.16.1.2.4 shall also be provided on the printed product label.

25.16.1.11 In addition to the compliance and information statements in 25.16.1.9 and 25.16.1.10, at least the following information shall also be printed on the product label(s) where all letters shall be at least 2 mm (5⁄64 in.) high:

(1) Manufacturer's name, identification, or designation
(2) Manufacturer's address
(3) Country of manufacture
(4) Manufacturer's product identification
(5) Model, style, lot, or serial number

25.16.1.12 Where detachable components must be used with the descent control device for the descent control device to be compliant with this standard, at least the following statement and information shall also be printed on the product label of the item. All letters shall be at least 2 mm (5⁄64 in.) high. The detachable component(s) shall be listed following the statement by type, identification, and how properly used.

TO BE COMPLIANT WITH NFPA 1983, INCORPORATED IN THE 2022 EDITION OF NFPA 2500, THE FOLLOWING ADDITIONAL COMPONENTS MUST BE USED IN CONJUNCTION WITH THIS DESCENT CONTROL DEVICE: [The detachable component(s) shall be listed here].

25.16.2 Descent Control Device User Information.

25.16.2.1 The manufacturer of a descent control device that is certified as being compliant with this standard shall furnish the purchaser with at least use criteria, inspection procedures, cleaning procedures, maintenance procedures, and retirement criteria for the product.

25.16.2.2 The manufacturer shall provide information for the user regarding at least the following issues:

(1) Inspecting the descent control device periodically according to the manufacturer's inspection procedure
(2) Removing the descent control device from service if the equipment does not pass inspection or if there is any doubt about the safety or serviceability of the equipment
(3) Maintaining the descent control device in accordance with the manufacturer's instructions where metal components are subjected to corrosion or deterioration
(4) Not exposing the rope or webbing used with the descent control device and any software component to flame or high temperature and carrying the equipment where it will be protected as it could melt or burn and fail if exposed to flame or high temperature

(5) Repairing the descent control device only in accordance with the manufacturer's instructions
(6) Keeping the user instructions/information after they are separated from the descent control device and retaining them in a permanent record; copying the user instructions/information and keeping the copy with the descent control device
(7) Referring to the user instructions/information before and after each use
(8) Cautioning that, if the instructions/information are not followed, the user could suffer serious consequences

25.16.2.3 The manufacturer shall provide information for the user that additional information regarding descent control devices can be found in NFPA 1500 and NFPA 1858 and NFPA 1983, incorporated in the 2022 edition of this standard.

25.16.2.4 The manufacturer of a descent control device that is certified as being compliant with this standard shall furnish the purchaser with a sample of suggested records to be maintained by the purchaser or user of the descent control device and a list of items that the records need to contain.

25.16.2.5 Because the descent control device is tested with a rope or escape webbing, one of the following statements shall be provided in the user instructions:

For rope:

THIS DESCENT CONTROL DEVICE HAS PASSED THE MANNER OF FUNCTION AND HOLDING LOAD TESTS USING THE FOLLOWING ROPE: [insert rope manufacturer name, designation, part number, and diameter here].

For escape webbing:

THIS DESCENT CONTROL DEVICE HAS PASSED THE MANNER OF FUNCTION AND HOLDING LOAD TESTS USING THE FOLLOWING ESCAPE WEBBING:[insert webbing manufacturer name, designation, part number, and perimeter here].

25.16.2.6 Where the descent control device has been tested with multiple ropes and/or escape webbings, each rope and/or escape webbing shall be listed in the user instructions.

25.17 Escape Anchors.

25.17.1 Escape Anchor Label Requirements.

25.17.1.1 Each escape anchor shall have a product label.

25.17.1.2 Each escape anchor shall have a product label stamped, engraved, or otherwise permanently marked with the portions of the product label information specified in 25.17.1.2.1 through 25.17.1.2.4.

25.17.1.2.1 Each escape anchor shall have the following compliance statement:

[NFPA 2500 (1983), 2022 ED.]

25.17.1.2.2 Each escape anchor shall display the mark or logo of the certification organization and the manufacturer's name or identifying mark.

25.17.1.2.3 Each escape anchor shall display at least the minimum rated breaking strength prefaced by the letters "MBS." The MBS value stated on the product label shall be permitted to be any value greater than the actual "pass" requirement value determined by the certification testing, but shall not be greater than the calculated MBS.

25.17.1.2.4 Each escape anchor shall display an "E" for escape-use items.

25.17.1.3 For the portions of the product label information not specified in 25.17.1.2.1 through 25.17.1.2.4, the product label shall be permitted to be a hang tag affixed to each individual escape anchor or shall be permitted to be printed on a sheet that is inserted and sealed in the packaging that immediately contains the escape anchor.

25.17.1.4 All letters shall be at least 2 mm ($\frac{5}{64}$ in.) high.

25.17.1.5 Multi-label pieces shall be permitted to carry all statements and information required to be on the product label; however, all label pieces constituting the entire product label shall be located adjacent to each other.

25.17.1.6 All worded portions of the required product label shall at least be in English.

25.17.1.7 Symbols and other pictorial graphic representations shall be permitted to be used to supplement worded statements on the product label(s).

25.17.1.8 The certification organization's label, symbol, or identifying mark shall be printed on the product label. All letters shall be at least 2 mm ($\frac{5}{64}$ in.) high.

25.17.1.9 Each escape anchor shall have the following compliance statement on the product label:

MEETS THE ESCAPE ANCHOR REQUIREMENTS OF NFPA 1983, INCORPORATED IN THE 2022 EDITION OF NFPA 2500.

25.17.1.10 In addition to the compliance statement specified in 25.17.1.9, at least the information required in 25.17.1.2.3 and 25.17.1.2.4 shall also be provided on the printed product label.

25.17.1.11 In addition to the compliance and information statements in 25.17.1.9 and 25.17.1.10, at least the following information shall also be printed on the product label(s) where all letters shall be at least 2 mm ($\frac{5}{64}$ in.) high:

(1) Manufacturer's name, identification, or designation
(2) Manufacturer's address
(3) Country of manufacture
(4) Manufacturer's product identification
(5) Model, style, lot, or serial number

25.17.2 Escape Anchor User Information.

25.17.2.1 The manufacturer of an escape anchor that is certified as being compliant with this standard shall furnish the purchaser with at least use criteria, inspection procedures, cleaning procedures, maintenance procedures, and retirement criteria for the product.

25.17.2.2 The manufacturer shall provide information for the user regarding at least the following issues:

(1) Inspecting the escape anchor periodically according to the manufacturer's inspection procedure
(2) Removing the escape anchor from service if the equipment does not pass inspection or if there is any doubt about the safety or serviceability of the equipment

(3) Maintaining the escape anchor in accordance with the manufacturer's instructions where metal components are subjected to corrosion or deterioration
(4) Keeping the user instructions/information after they are separated from the escape anchor and retaining them in a permanent record; copying the user instructions/information and keeping the copy with the equipment
(5) Referring to the user instructions/information before and after each use
(6) Cautioning that the escape anchor can only be used within the scope of this document and use outside the scope of this document could have serious consequences

25.17.2.3 The manufacturer shall provide information for the user that additional information regarding escape anchors can be found in NFPA 1500 and NFPA 1858 and NFPA 1983, incorporated in the 2022 edition of this standard.

25.17.2.4 The manufacturer of an escape anchor that is certified as being compliant with this standard shall furnish the purchaser with a sample of suggested records to be maintained by the purchaser or user of the escape anchor and a list of items that the records need to contain.

25.17.2.5* The manufacturer shall provide instructions on how the escape anchor should be loaded.

25.17.2.6 The manufacturer shall provide guidance to the end user regarding the capabilities and limitations of the escape anchor and how to use it within those capabilities and limitations.

25.17.2.7 The manufacturer shall provide a statement that training is necessary before use.

25.18 Litters.

25.18.1 Litter Label Requirements.

25.18.1.1 Each litter shall have a product label.

25.18.1.2 Each litter shall have a product label stamped, engraved, or otherwise permanently marked with the portions of the product label information specified in 25.18.1.2.1 through 25.18.1.2.2.

25.18.1.2.1 Each litter shall have the following compliance statement:

[NFPA 2500 (1983), 2022 ED.]

25.18.1.2.2 Each litter shall display the mark or logo of the certification organization and the manufacturer's name or identifying mark.

25.18.1.3 For the portions of the product label information not specified in 25.18.1.2.1 and 25.18.1.2.2, the product label shall be permitted to be a hang tag affixed to each individual litter.

25.18.1.4 All letters shall be at least 2 mm ($\frac{5}{64}$ in.) high.

25.18.1.5 Multi-label pieces shall be permitted to carry all statements and information required to be on the product label; however, all label pieces comprising the entire product label shall be located adjacent to each other.

25.18.1.6 All worded portions of the required product label shall be at least in English.

25.18.1.7 Symbols and other pictorial graphic representations shall be permitted to be used to supplement worded statements on the product label(s).

25.18.1.8 The certification organization's label, symbol, or identifying mark shall be printed on the product label. All letters shall be at least 2 mm ($\frac{5}{64}$ in.) high.

25.18.1.9 Each litter shall have the following compliance statement on the product label:

MEETS THE LITTER REQUIREMENTS OF NFPA 1983, INCORPORATED IN THE 2022 EDITION OF NFPA 2500.

25.18.1.10 In addition to the compliance statement specified in 25.18.1.9, litters shall include the following additional information on the product label:

VERTICAL BREAKING STRENGTH: _____kN.

HORIZONTAL BREAKING STRENGTH: _____kN

25.18.1.11 In addition to the compliance and information statements in 25.18.1.9 and 25.18.1.10, at least the following information shall also be printed on the product label(s)where all letters shall be at least 2 mm ($\frac{5}{64}$ in.) high.

(1) Manufacturer's name, identification, or designation
(2) Manufacturer's address
(3) Country of manufacture
(4) Manufacturer's product identification
(5) Model, style, lot, or serial number

25.18.2 Litter User Information.

25.18.2.1 The manufacturer of the litter that is certified as being compliant with this standard shall furnish the purchaser with at least use criteria, inspection procedures, cleaning procedures, maintenance procedures, and retirement criteria for the product.

25.18.2.2 The manufacturer shall provide information for the user regarding at least the following issues:

(1) Inspecting the litter periodically according to the manufacturer's inspection procedure
(2) Removing the litter from service if the equipment does not pass inspection or if there is any doubt about the safety or serviceability of the equipment
(3) Maintaining the litter in accordance with the manufacturer's instructions where metal components are subjected to corrosion or deterioration
(4) Not exposing any software component of the litter to flame or high temperature and carrying the equipment where it will be protected as it could melt or burn and fail if exposed to flame or high temperature
(5) Repairing the litter only in accordance with the manufacturer's instructions
(6) Keeping the user instructions/information after they are separated from the litter and retaining them in a permanent record; copying the user instructions/information and keeping the copy with the equipment
(7) Referring to the user instructions/information before and after each use
(8) Cautioning that, if the instructions/information are not followed, the user could suffer serious consequences

25.18.2.3 The manufacturer shall provide information for the user that additional information regarding litters can be found

in NFPA 1500 and NFPA 1858 and NFPA 1983, incorporated in the 2022 edition of this standard.

25.18.2.4 The manufacturer of a litter that is certified as being compliant with this standard shall furnish the purchaser with a sample of suggested records to be maintained by the purchaser or user of the litter and a list of items that the records need to contain.

25.19 Portable Anchors.

25.19.1 Portable Anchor Label Requirements.

25.19.1.1 Each portable anchor shall have a product label.

25.19.1.2 Each portable anchor shall have a product label stamped, engraved, or otherwise permanently marked with the portions of the product label information specified in 25.19.1.2.1 through 25.19.1.2.4.

25.19.1.2.1 Each portable anchor shall have the following compliance statement:

[NFPA 2500 (1983), 2022 ED.]

25.19.1.2.2 Each portable anchor shall display the mark or logo of the certification organization and the manufacturer's name or identifying mark.

25.19.1.2.3 Each portable anchor shall display at least the minimum rated breaking strength prefaced by the letters "MBS." The MBS value stated on the product label shall be permitted to be any value greater than the actual "pass" requirement value determined by the certification testing, but shall not be greater than the calculated MBS.

25.19.1.2.4 Each portable anchor shall display a "G" for general-use items or a "T" for technical-use items. The designation "G" or "T" shall be designated in accordance with 26.19.1.2.

25.19.1.3 For the portions of the product label information not specified in 25.19.1.2.1 through 25.19.1.2.4, the product label shall be permitted to be a hang tag affixed to each portable anchor or shall be permitted to be printed on a sheet that is inserted and sealed in the packaging that immediately contains the portable anchor.

25.19.1.4 All letters shall be at least 2 mm (5⁄64 in.) high.

25.19.1.5 Multi-label pieces shall be permitted to carry all statements and information required to be on the product label; however, all label pieces comprising the entire product label shall be located adjacent to each other.

25.19.1.6 All worded portions of the required product label shall at least be in English.

25.19.1.7 Symbols and other pictorial graphic representations shall be permitted to be used to supplement worded statements on the product label(s).

25.19.1.8 The certification organization's label, symbol, or identifying mark shall be printed on the product label. All letters shall be at least 2 mm (5⁄64 in.) high.

25.19.1.9 Each portable anchor shall have the following compliance statement on the product label:

MEETS THE PORTABLE ANCHOR REQUIREMENTS OF NFPA 1983, INCORPORATED IN THE 2022 EDITION OF NFPA 2500.

25.19.1.10 In addition to the compliance statement specified in 25.19.1.9, at least the information required in 25.19.1.2.3 through 25.19.1.2.4 shall also be provided on the printed product label.

25.19.1.11 In addition to the compliance statement specified in 25.19.1.9, portable anchors shall include the following additional information on the product label:

MINIMUM BREAKING STRENGTH AND RATING ARE DETERMINED AT THE CONFIGURATION OF LOWEST STRENGTH PER MANUFACTURER'S INSTRUCTIONS.

25.19.1.12 In addition to the compliance and information statements in 25.19.1.9, 25.19.1.10, and 25.19.1.11, at least the following information shall also be printed on the product label(s) where all letters shall be at least 2 mm (5⁄64 in.) high:

(1) Manufacturer's name, identification, or designation
(2) Manufacturer's address
(3) Country of manufacture
(4) Manufacturer's product identification
(5) Model, style, lot, or serial number

25.19.1.13 Where detachable components must be used with the portable anchor for the portable anchor to be compliant with this standard, at least the following statement and information shall also be printed on the product label of the item. All letters shall be at least 2 mm (5⁄64 in.) high. The detachable component(s) shall be listed following the statement by type, identification, and how properly used.

TO BE COMPLIANT WITH NFPA 1983, INCORPORATED IN THE 2022 EDITION OF NFPA 2500, THE FOLLOWING ADDITIONAL COMPONENTS MUST BE USED IN CONJUNCTION WITH THIS PORTABLE ANCHOR: [The detachable component(s) shall be listed here.]

25.19.2 Portable Anchor User Information.

25.19.2.1 The manufacturer of the portable anchor that is certified as being compliant with this standard shall furnish the purchaser with at least use criteria, inspection procedures, cleaning procedures, maintenance procedures, and retirement criteria for the product.

25.19.2.2 The manufacturer shall provide information for the user regarding at least the following issues:

(1) Inspecting the portable anchor periodically according to the manufacturer's inspection procedure
(2) Removing the portable anchor from service if the equipment does not pass inspection or if there is any doubt about the safety or serviceability of the equipment
(3) Maintaining the portable anchor in accordance with the manufacturer's instructions where metal components are subjected to corrosion or deterioration
(4) Repairing the portable anchor only in accordance with the manufacturer's instructions
(5) Keeping the user instructions/information after they are separated from the portable anchor and retaining them in a permanent record; copying the user instructions/information and keeping the copy with the equipment
(6) Referring to the user instructions/information before and after each use
(7) Cautioning that, if the instructions/information are not followed, the user could suffer serious consequences

25.19.2.3 The manufacturer shall provide information for the user that additional information regarding portable anchors can be found in NFPA 1500 and NFPA 1858 and NFPA 1983, incorporated in the 2022 edition of this standard.

25.19.2.4 The manufacturer of a portable anchor that is certified as being compliant with this standard shall furnish the purchaser with a sample of suggested records to be maintained by the purchaser or user of the portable anchor and a list of items that the records need to contain.

25.19.2.5 The manufacturer of portable anchors shall provide information for the user that indicates the actual configuration of the device when meeting the breaking strength requirement, including the height, attachment points, and angular configuration of the legs, such that the user can set up the equipment in the same configuration as tested.

25.20 Pulleys.

25.20.1 Pulley Label Requirements.

25.20.1.1 Each pulley shall have a product label.

25.20.1.2 Each pulley shall have a product label stamped, engraved, or otherwise permanently marked with the portions of the product label information specified in 25.20.1.2.1 through 25.20.1.2.4.

25.20.1.2.1 Each pulley shall have the following compliance statement:

[NFPA 2500 (1983), 2022 ED.]

25.20.1.2.2 Each pulley shall display the mark or logo of the certification organization and the manufacturer's name or identifying mark.

25.20.1.2.3 Each pulley shall display at least the minimum rated breaking strength prefaced by the letters "MBS." The MBS value stated on the product label shall be permitted to be any value greater than the actual "pass" requirement value determined by the certification testing, but shall not be greater than the calculated MBS.

25.20.1.2.4 Each pulley shall display a "G" for general-use items or "T" for technical-use items. The designation "G" or "T" shall be designated in accordance with 26.20.1.2.

25.20.1.3 For the portions of the product label information not specified in 25.20.1.2.1 through 25.20.1.2.4, the product label shall be permitted to be a hang tag affixed to each individual pulley or shall be permitted to be printed on a sheet that is inserted and sealed in the packaging that immediately contains the pulley.

25.20.1.4 All letters shall be at least 2 mm (5⁄64 in.) high.

25.20.1.5 Multi-label pieces shall be permitted to carry all statements and information required to be on the product label; however, all label pieces comprising the entire product label shall be located adjacent to each other.

25.20.1.6 All worded portions of the required product label shall at least be in English.

25.20.1.7 Symbols and other pictorial graphic representations shall be permitted to be used to supplement worded statements on the product label(s).

25.20.1.8 The certification organization's label, symbol, or identifying mark shall be printed on the product label. All letters shall be at least 2 mm (5⁄64 in.) high.

25.20.1.9 Each pulley shall have the following compliance statement on the product label:

MEETS THE PULLEY REQUIREMENTS OF NFPA 1983, INCORPORATED IN THE 2022 EDITION OF NFPA 2500.

25.20.1.10 In addition to the compliance statement specified in 25.20.1.9, at least the information required in 25.20.1.2.3 and 25.20.1.2.4 shall also be provided on the printed product label.

25.20.1.11 In addition to the compliance and information statements in 25.20.1.9 and 25.20.1.10, at least the following information shall also be printed on the product label(s) where all letters shall be at least 2 mm (5⁄64 in.) high:

(1) Manufacturer's name, identification, or designation
(2) Manufacturer's address
(3) Country of manufacture
(4) Manufacturer's product identification
(5) Model, style, lot, or serial number

25.20.2 Pulley User Information.

25.20.2.1 The manufacturer of a pulley that is certified as being compliant with this standard shall furnish the purchaser with at least use criteria, inspection procedures, cleaning procedures, maintenance procedures, and retirement criteria for the product.

25.20.2.2 The manufacturer shall provide information for the user regarding at least the following issues:

(1) Inspecting the pulley periodically according to the manufacturer's inspection procedure
(2) Removing the pulley from service if the equipment does not pass inspection or if there is any doubt about the safety or serviceability of the equipment
(3) Maintaining the pulley in accordance with the manufacturer's instructions where metal components are subjected to corrosion or deterioration
(4) Returning the pulley to the manufacturer or to a qualified inspection person/center if the equipment is dropped or impact-loaded
(5) Repairing the pulley only in accordance with the manufacturer's instructions
(6) Keeping the user instructions/information after they are separated from the pulley and retaining them in a permanent record; copying the user instructions/information and keeping the copy with the equipment
(7) Referring to the user instructions/information before and after each use
(8) Cautioning that, if the instructions/information are not followed, the user could suffer serious consequences

25.20.2.3 The manufacturer shall provide information for the user that additional information regarding pulleys can be found in NFPA 1500 and NFPA 1858 and NFPA 1983, incorporated in the 2022 edition of this standard.

25.20.2.4 The manufacturer of a pulley that is certified as being compliant with this standard shall furnish the purchaser with a sample of suggested records to be maintained by the purchaser or user of the pulley and a list of items that the records need to contain.

25.21 Rope Grabs and Ascending Devices.

25.21.1 Rope Grab and Ascending Device Label Requirements.

25.21.1.1 Each rope grab and ascending device shall have a product label.

25.21.1.2 Each rope grab and ascending device shall have a product label stamped, engraved, or otherwise permanently marked with the portions of the product label information specified in 25.21.1.2.1 through 25.21.1.2.4.

25.21.1.2.1 Each rope grab and ascending device shall have the following compliance statement:

[NFPA 2500 (1983), 2022 ED.]

25.21.1.2.2 Each rope grab and ascending device shall display the mark or logo of the certification organization and the manufacturer's name or identifying mark.

25.21.1.2.3 Each rope grab and ascending device shall display a "G" for general use or "T" for technical use. The designation "G" or "T" shall be designated in accordance with 26.21.1.2.

25.21.1.2.4 Each rope grab and ascending device shall display the range of rope diameters with which the device is intended to be used.

25.21.1.3 For the portions of the product label information not specified in 25.22.1.2.4 through 25.22.1.2.1, the product label shall be permitted to be a hang tag affixed to each individual rope grab or ascending device or shall be permitted to be printed on a sheet that is inserted and sealed in the packaging that immediately contains the rope grab or ascending device.

25.21.1.4 All letters shall be at least 2 mm ($\frac{5}{64}$ in.) high.

25.21.1.5 Multi-label pieces shall be permitted to carry all statements and information required to be on the product label; however, all label pieces comprising the entire product label shall be located adjacent to each other.

25.21.1.6 All worded portions of the required product label shall at least be in English.

25.21.1.7 Symbols and other pictorial graphic representations shall be permitted to be used to supplement worded statements on the product label(s).

25.21.1.8 The certification organization's label, symbol, or identifying mark shall be printed on the product label. All letters shall be at least 2 mm ($\frac{5}{64}$ in.) high.

25.21.1.9 Each rope grab and ascending device shall have the following compliance statement on the product label:

MEETS THE [insert ROPE GRAB OR ASCENDING DEVICE here] REQUIREMENTS OF NFPA 1983, INCORPORATED IN THE 2022 EDITION OF NFPA 2500.

25.21.1.10 In addition to the compliance statement specified in 25.21.1.9, at least the information required in 25.21.1.2.3 and 25.21.1.2.4 shall also be provided on the printed product label.

25.21.1.11 In addition to the compliance and information statements in 25.21.1.9 and 25.21.1.10, at least the following information shall also be printed on the product label(s) where all letters shall be at least 2 mm ($\frac{5}{64}$ in.) high:

(1) Manufacturer's name, identification, or designation
(2) Manufacturer's address
(3) Country of manufacture
(4) Manufacturer's product identification
(5) Model, style, lot, or serial number

25.21.2 Rope Grab and Ascending Devices User Information.

25.21.2.1 The manufacturer of a rope grab or ascending device that is certified as being compliant with this standard shall furnish the purchaser with at least use criteria, inspection procedures, cleaning procedures, maintenance procedures, and retirement criteria for the product.

25.21.2.2 The manufacturer shall provide information for the user regarding at least the following issues:

(1) Inspecting the rope grab or ascending device periodically according to the manufacturer's inspection procedure
(2) Removing the rope grab or ascending device from service if the equipment does not pass inspection or if there is any doubt about the safety or serviceability of the equipment
(3) Maintaining the rope grab or ascending device in accordance with the manufacturer's instructions where metal components are subjected to corrosion or deterioration
(4) Repairing the rope grab or ascending device only in accordance with the manufacturer's instructions
(5) Keeping the user instructions/information after they are separated from the rope grab or ascending device and retaining them in a permanent record; copying the user instructions/information and keeping the copy with the equipment
(6) Referring to the user instructions/information before and after each use
(7) Cautioning that, if the instructions/information are not followed, the user could suffer serious consequences

25.21.2.3 The manufacturer shall provide information for the user that additional information regarding rope grabs and ascending devices can be found in NFPA 1500 and NFPA 1858 and NFPA 1983, incorporated in the 2022 edition of this standard.

25.21.2.4 The manufacturer of a rope grab or ascending device that is certified as being compliant with this standard shall furnish the purchaser with a sample of suggested records to be maintained by the purchaser or user of the rope grab or ascending device and a list of items that the records need to contain.

25.21.2.5 Because a rope grab or ascending device is tested with a rope, the following statement shall be provided in the user instructions:

THIS [insert ROPE GRAB OR ASCENDING DEVICE here] HAS PASSED THE MANNER OF FUNCTION TEST USING THE FOLLOWING ROPE: [insert rope manufacturer name, designation, part number, and diameter here].

25.21.2.6 Where the rope grab or ascending device has been tested with multiple ropes, each rope shall be listed in the user instructions.

25.22 Other Auxiliary Equipment.

25.22.1 Other Auxiliary Equipment Label Requirements.

25.22.1.1 Each auxiliary equipment item shall have a product label.

25.22.1.2 Each load-bearing hardware auxiliary equipment item shall have a product label stamped, engraved, or otherwise permanently marked with the portions of the product label information specified in 25.22.1.2.1 through 25.22.1.2.4.

25.22.1.2.1 Each load-bearing hardware auxiliary equipment item shall have the following compliance statement:

[NFPA 2500 (1983), 2022 ED.]

25.22.1.2.2 Each load-bearing hardware auxiliary equipment shall display the mark or logo of the certification organization and the manufacturer's name or identifying mark.

25.22.1.2.3 Each load-bearing hardware auxiliary equipment shall display at least the minimum rated breaking strength prefaced by the letters "MBS." The MBS value stated on the product label shall be permitted to be any value greater than the actual "pass" requirement value determined by the certification testing, but shall not be greater than the calculated MBS.

25.22.1.2.4 Each load-bearing hardware auxiliary equipment shall display a "G" for general-use items, a "T" for technical-use items, or an "E" for escape-use items. The designation "G," "T," or "E" shall be designated in accordance with 26.22.1.2.

25.22.1.3 For the portions of the product label information not specified in 25.22.1.2.1 through 25.22.1.2.4, the product label shall be permitted to be a hang tag affixed to each individual auxiliary equipment item or shall be permitted to be printed on a sheet that is inserted and sealed in the packaging that immediately contains the auxiliary equipment item.

25.22.1.4 All letters shall be at least 2 mm (5⁄64 in.) high.

25.22.1.5 Multi-label pieces shall be permitted to carry all statements and information required to be on the product label; however, all label pieces comprising the entire product label shall be located adjacent to each other.

25.22.1.6 All worded portions of the required product label shall at least be in English.

25.22.1.7 Symbols and other pictorial graphic representations shall be permitted to be used to supplement worded statements on the product label(s).

25.22.1.8 The certification organization's label, symbol, or identifying mark shall be printed on the product label. All letters shall be at least 2 mm (5⁄64 in.) high.

25.22.1.9 Each auxiliary equipment item shall have the following compliance statement on the product label:

THIS [insert name of equipment item here] MEETS THE AUXILIARY EQUIPMENT REQUIREMENTS OF NFPA 1983, INCORPORATED IN THE 2022 EDITION OF NFPA 2500.

25.22.1.10 In addition to the compliance statement specified in 25.22.1.9, at least the information required in 25.22.1.2.3 through 25.22.1.2.4 shall also be provided on the printed product label.

25.22.1.11 In addition to the compliance and information statements in 25.22.1.9, and 25.22.1.10, at least the following information shall also be printed on the product label(s) where all letters shall be at least 2 mm (5⁄64 in.) high:

(1) Manufacturer's name, identification, or designation
(2) Manufacturer's address
(3) Country of manufacture
(4) Manufacturer's product identification
(5) Model, style, lot, or serial number

25.22.1.12 Where detachable components must be used with the auxiliary equipment item for the auxiliary equipment item to be compliant with this standard, at least the following statement and information shall also be printed on the product label of the item. All letters shall be at least 2 mm (5⁄64 in.) high. The detachable component(s) shall be listed following the statement by type, identification, and how properly used.

TO BE COMPLIANT WITH NFPA 1983, INCORPORATED IN THE 2022 EDITION OF NFPA 2500, THE FOLLOWING ADDITIONAL COMPONENTS MUST BE USED IN CONJUNCTION WITH THIS [insert type of auxiliary equipment here]: [The detachable component(s) shall be listed here.]

25.22.2 Other Auxiliary Equipment User Information.

25.22.2.1 The manufacturer of auxiliary equipment that is certified as being compliant with this standard shall furnish the purchaser with at least use criteria, inspection procedures, cleaning procedures, maintenance procedures, and retirement criteria for the product.

25.22.2.2 The manufacturer shall provide information for the user regarding at least the following issues:

(1) Inspecting the auxiliary equipment periodically according to the manufacturer's inspection procedure.
(2) Removing the auxiliary equipment from service if the equipment does not pass inspection or if there is any doubt about the safety or serviceability of the equipment.
(3) Maintaining the auxiliary equipment in accordance with the manufacturer's instructions where metal components are subjected to corrosion or deterioration.
(4) Not exposing the software of the auxiliary equipment to flame or high temperature and carrying the equipment where it will be protected as it could melt or burn and fail if exposed to flame or high temperature.
(5) Repairing the auxiliary equipment only in accordance with the manufacturer's instructions.
(6) Keeping the user instructions/information after they are separated from the auxiliary equipment and retaining them in a permanent record; copying the user instructions/information and keeping the copy with the equipment.
(7) Referring to the user instructions/information before and after each use.
(8) Cautioning that, if the instructions/information are not followed, the user could suffer serious consequences.

25.22.2.3 The manufacturer shall provide information for the user that additional information regarding auxiliary equipment can be found in NFPA 1500 and NFPA 1858 and NFPA 1983, incorporated in the 2022 edition of this standard.

25.22.2.4 The manufacturer of auxiliary equipment that is certified as being compliant with this standard shall furnish the purchaser with a sample of suggested records to be maintained by the purchaser or user of the auxiliary equipment and a list of items that the records need to contain.

25.23 Escape Systems.

25.23.1 Escape Systems Label Requirements.

25.23.1.1 Each escape system shall have a product label.

25.23.1.2 Each escape system load-bearing component shall have a product label stamped, engraved, or otherwise permanently marked with the portions of the product label information specified in 25.23.1.2.1 and 25.23.1.2.2.

25.23.1.2.1 Each escape system load-bearing component shall have the following compliance statement:

[NFPA 2500 (1983), 2022 ED.]

25.23.1.2.2 Each escape system load-bearing component shall display the manufacturer's name or identifying mark.

25.23.1.3 For the portions of the product label information not specified in 25.23.1.2.1, the product label shall be permitted to be a hang tag affixed to each individual escape system load-bearing component or shall be permitted to be printed on a sheet that is inserted and sealed in the packaging that immediately contains the escape system load-bearing component.

25.23.1.4 All letters shall be at least 2 mm (5/64 in.) high.

25.23.1.5 Multi-label pieces shall be permitted to carry all statements and information required to be on the product label.

25.23.1.5.1 All label pieces constituting the entire product label shall be located adjacent to each other.

25.23.1.6 All worded portions of the required product label shall be at least in English.

25.23.1.7 Symbols and other pictorial representations shall be permitted to be used to supplement worded statements on the product label(s).

25.23.1.8 The certification organization's label, symbol, or identifying mark shall be printed on the product label in letters at least 2.5 mm (3/32 in.) high.

25.23.1.9 Each escape system shall have the following compliance statement on the product label:

MEETS THE ESCAPE SYSTEM REQUIREMENTS OF NFPA 1983, INCORPORATED IN THE 2022 EDITION OF NFPA 2500. DO NOT DISASSEMBLE. DO NOT USE IN FIRE ENVIRONMENTS.

25.23.1.10 In addition to the compliance statement in 25.23.1.9, at least the following information shall also be printed on the product label(s) in letters at least 2 mm (5/64 in.) high:

(1) Manufacturer's name, identification, or designation
(2) Manufacturer's address
(3) Country of manufacture
(4) Manufacturer's product identification
(5) Model, style, lot, or serial number

25.23.1.11 Where detachable components must be used with the escape system for the escape system to be compliant with this standard, at least the following statement and information shall also be printed on the product label of the item in letters at least 2.5 mm (3/32 in.) high.

TO BE COMPLIANT WITH NFPA 1983, INCORPORATED IN THE 2022 EDITION OF NFPA 2500, THE FOLLOWING ADDITIONAL COMPONENTS MUST BE USED IN CONJUNCTION WITH THIS [insert type of escape system here]: [The detachable component(s) are listed here.]

25.23.1.11.1 The detachable component(s) shall be listed following the statement by type, identification, and proper use.

25.23.2 Escape Systems User Information.

25.23.2.1 The manufacturer of an escape system that is certified as being compliant with this standard shall furnish the purchaser with at least use criteria, inspection procedures, cleaning procedures, maintenance procedures, and retirement criteria for the product.

25.23.2.2 The manufacturer shall provide information for the user regarding at least the following issues:

(1) Inspecting the escape system periodically according to the manufacturer's inspection procedure
(2) Removing the escape system from service if the equipment does not pass inspection or if there is any doubt about the safety or serviceability of the equipment
(3) Maintaining the escape system in accordance with the manufacturer's instructions where metal components are subjected to corrosion or deterioration
(4) Removing the escape system from service if the equipment is subjected to an impact load
(5) Not exposing the software of the escape system to flame or high temperature and carrying the equipment where it will be protected as it could melt or burn and fail if exposed to flame or high temperature
(6) Repairing the escape system only in accordance with the manufacturer's instructions
(7) Keeping the user instructions/information after they are separated from the escape system and retaining them in a permanent record; copying the user instructions/information and keeping the copy with the equipment
(8) Referring to the user instructions/information before and after each use
(9) Cautioning that, if the instructions/information are not followed, the user could suffer serious consequences

25.23.2.3 The manufacturer shall provide information for the user that additional information regarding escape systems can be found in NFPA 1500 and NFPA 1858 and NFPA 1983, incorporated in the 2022 edition of this standard.

25.23.2.4 The manufacturer of an escape system that is certified as being compliant with this standard shall furnish the purchaser with a sample of suggested records to be maintained by the purchaser or user of the escape system and a list of items that the records need to contain.

25.23.2.5 The compliant configuration(s) used in the payout test shall be described.

25.24 Fire Escape Systems.

25.24.1 Fire Escape System Label Requirements.

25.24.1.1 Each fire escape system shall have a product label.

25.24.1.2 Each fire escape system load-bearing component shall have a product label stamped, engraved, or otherwise permanently marked with the portions of the product label information specified in 25.24.1.2.1 and 25.24.1.2.2.

25.24.1.2.1 Each fire escape system load-bearing component shall have the following compliance statement:

[NFPA 2500 (1983), 2022 ED.]

25.24.1.2.2 Each fire escape system load-bearing component shall display the manufacturer's name or identifying mark.

25.24.1.3 For the portions of the product label information not specified in 25.24.1.2.1, the product label shall be permitted to be a hang tag affixed to each individual fire escape system load-bearing component or shall be permitted to be printed on a sheet that is inserted and sealed in the packaging that immediately contains the fire escape system.

25.24.1.4 All letters shall be at least 2 mm (5⁄64 in.) high.

25.24.1.5 Multi-label pieces shall be permitted to carry all statements and information required to be on the product label.

25.24.1.5.1 All label pieces comprising the entire product label shall be located adjacent to each other.

25.24.1.6 All worded portions of the required product label shall be at least in English.

25.24.1.7 Symbols and other pictorial representations shall be permitted to be used to supplement worded statements on the product label(s).

25.24.1.8 The certification organization's label, symbol, or identifying mark shall be printed on the product label in letters at least 2.5 mm (3⁄32 in.) high.

25.24.1.9 Each fire escape system shall have the following compliance statement on the product label:

MEETS THE FIRE ESCAPE SYSTEM REQUIREMENTS OF NFPA 1983, INCORPORATED IN THE 2022 EDITION OF NFPA 2500. DO NOT DISASSEMBLE.

25.24.1.10 In addition to the compliance statement in 25.24.1.9, at least the following information shall also be printed on the product label(s) in letters at least 2 mm (5⁄64 in.) high:

(1) Manufacturer's name, identification, or designation
(2) Manufacturer's address
(3) Country of manufacture
(4) Manufacturer's product identification
(5) Model, style, lot, or serial number

25.24.1.11 Where detachable components must be used with the fire escape system for the fire escape system to be compliant with this standard, at least the following statement and information shall also be printed on the product label of the item in letters at least 2.5 mm (3⁄32 in.) high.

TO BE COMPLIANT WITH NFPA 1983, INCORPORATED IN THE 2022 EDITION OF NFPA 2500, THE FOLLOWING ADDITIONAL COMPONENTS MUST BE USED IN CONJUNCTION WITH THIS FIRE ESCAPE SYSTEM: [The detachable component(s) are listed here.]

25.24.1.11.1 The detachable component(s) shall be listed following the statement by type, identification, and proper use.

25.24.2 Fire Escape Systems User Information.

25.24.2.1 The manufacturer of a fire escape system that is certified as being compliant with this standard shall furnish the purchaser with at least use criteria, inspection procedures, cleaning procedures, maintenance procedures, and retirement criteria for the product.

25.24.2.2 The manufacturer shall provide information for the user regarding at least the following issues:

(1) Inspecting the fire escape system periodically according to the manufacturer's inspection procedure
(2) Removing the fire escape system from service if the equipment does not pass inspection or if there is any doubt about the safety or serviceability of the equipment
(3) Maintaining the fire escape system in accordance with the manufacturer's instructions where metal components are subjected to corrosion or deterioration
(4) Removing the fire escape system from service if the equipment is subjected to an impact load
(5) Carrying the equipment, where feasible, in a location where it will be protected from exposure to flame and high temperatures to avoid degradation of the materials
(6) Repairing the fire escape system only in accordance with the manufacturer's instructions
(7) Keeping the user instructions/information after they are separated from the fire escape system and retaining them in a permanent record; copying the user instructions/information and keeping the copy with the equipment
(8) Referring to the user instructions/information before and after each use
(9) Cautioning that, if the instructions/information are not followed, the user could suffer serious consequences

25.24.2.3 The manufacturer shall provide information for the user that additional information regarding fire escape systems can be found in NFPA 1500 and NFPA 1858 and NFPA 1983, incorporated in the 2022 edition of this standard.

25.24.2.4 The manufacturer of a fire escape system that is certified as being compliant with this standard shall furnish the purchaser with a sample of suggested records to be maintained by the purchaser or user of the fire escape system and a list of items that the records need to contain.

25.24.2.5 The compliant configuration(s) used in the payout test shall be described.

25.25 Manufactured Systems.

25.25.1 Manufactured System Label Requirements.

25.25.1.1 Each manufactured system shall have a product label.

25.25.1.2 Each manufactured system load-bearing hardware component shall have a product label stamped, engraved, or otherwise permanently marked with the portions of the product label information specified in 25.25.1.2.1 through 25.25.1.2.5.

25.25.1.2.1 Each manufactured system load-bearing hardware component shall display the manufacturer's name or identifying mark.

25.25.1.2.2 Manufactured systems shall have the following compliance statement:

[NFPA 2500 (1983), 2022 ED.]

25.25.1.2.3 Manufactured systems shall display at least the minimum rated breaking strength prefaced by the letters "MBS."

25.25.1.2.4 The MBS value stated on the product label shall be permitted to be any value greater than the actual "pass"

requirement value determined by the certification testing, but shall not be greater than the calculated MBS.

25.25.1.2.5 Manufactured systems shall display a "T" for technical-use manufactured system or "G" for general-use manufactured system.

25.25.1.2.5.1 The designation "T" or "G" shall be determined in accordance with 27.25.2 or 27.25.4.

25.25.1.3 For the portions of the product label information not specified in 25.25.1.2 through 25.25.1.2.5, the product label shall be permitted to be a hang tag affixed to each manufactured system or shall be permitted to be printed on a sheet that is inserted and sealed in the packaging that immediately contains the manufactured system.

25.25.1.4 All letters shall be at least 2 mm (5⁄64 in.) high.

25.25.1.5 Multi-label pieces shall be permitted to carry all statements and information required to be on the product label; however, all label pieces comprising the entire product label shall be located adjacent to each other.

25.25.1.6 All worded portions of the required product label shall at least be in English.

25.25.1.7 Symbols and other pictorial graphic representations shall be permitted to be used to supplement worded statements on the product label(s).

25.25.1.8 The certification organization's label, symbol, or identifying mark shall be printed on the product label. All letters shall be at least 2 mm (5⁄64 in.) high.

25.25.1.9 Each manufactured system shall have the following compliance statement on the product label:

MEETS THE MANUFACTURED SYSTEM REQUIREMENTS OF NFPA 1983, INCORPORATED IN THE 2022 EDITION OF NFPA 2500. DO NOT DISASSEMBLE.

25.25.1.10 In addition to the compliance statement specified in 25.25.1.9, at least the information required in 25.25.1.2.1 shall also be provided on the printed product label.

25.25.1.11 In addition to the compliance and information statements in 25.25.1.9 and 25.25.1.10, at least the following information shall also be printed on the product label(s) where all letters shall be at least 2 mm (5⁄64 in.) high:

(1) Manufacturer's name, identification, or designation
(2) Manufacturer's address
(3) Country of manufacture
(4) Manufacturer's product identification
(5) Model, style, lot, or serial number

25.25.1.12 Where detachable components must be used with the manufactured system for the manufactured system to be compliance with this standard, at least the following statement and information shall also be printed on the product label of the item. All letters shall be at least 2 mm (5⁄64 in.) high. The detachable component(s) shall be listed following the statement by type, identification, and how properly used.

TO BE COMPLIANT WITH NFPA 1983, INCORPORATED IN THE 2022 EDITION OF NFPA 2500, THE FOLLOWING ADDITIONAL COMPONENTS MUST BE USED IN CONJUNCTION WITH THIS MANUFACTURED SYSTEM: [The detachable component(s) shall be listed here].

25.25.2 Manufactured Systems User Information.

25.25.2.1 The manufacturer of a manufactured system that is certified as being compliant with this standard shall furnish the purchaser with at least use criteria, inspection procedures, cleaning procedures, maintenance procedures, and retirement criteria for the product.

25.25.2.2 The manufacturer shall provide information for the user regarding at least the following issues:

(1) Inspecting the manufactured system periodically according to the manufacturer's inspection procedure
(2) Removing the manufactured system from service if the equipment does not pass inspection or if there is any doubt about the safety or serviceability of the equipment
(3) Maintaining the manufactured system in accordance with the manufacturer's instructions where metal components are subjected to corrosion or deterioration
(4) Not exposing the software components of the manufactured system to flame or high temperature and carrying the equipment where it will be protected as it could melt or burn and fail if exposed to flame or high temperature
(5) Repairing the manufactured system only in accordance with the manufacturer's instructions
(6) Keeping the user instructions/information after they are separated from the manufactured system and retaining them in a permanent record; copying the user instructions/information and keeping the copy with the equipment
(7) Referring to the user instructions/information before and after each use
(8) Cautioning that, if the instructions/information are not followed, the user could suffer serious consequences

25.25.2.3 The manufacturer shall provide information for the user that additional information regarding manufactured systems can be found in NFPA 1500 and NFPA 1858 and NFPA 1983, incorporated in the 2022 edition of this standard.

25.25.2.4 The manufacturer of manufactured systems certified as being compliant with this standard shall furnish the purchaser with a sample of suggested records to be maintained by the purchaser or user of the manufactured system auxiliary equipment.

Chapter 26 Design and Construction Requirements (NFPA 1983)

26.1 Life Safety Rope.

26.1.1 Life Safety Rope Design Requirements.

26.1.1.1 Life safety rope shall be designated by the manufacturer for its intended use and design load as either technical use or general use.

26.1.1.2* Life safety rope shall be constructed of virgin fiber.

26.1.1.3 Life safety rope shall be of block creel construction.

26.1.1.4 Primary load-bearing elements of life safety rope shall be constructed of continuous filament fiber.

26.1.1.5 Where life safety rope is a component of equipment with electric-current carrying capabilities, the equipment, including the life safety rope, shall meet the requirements of UL 913, *Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, III, Division 1, Hazardous (Classified) Locations,*

for Class I, Division 1, Groups A, B, C, and D and Class II, Division 1, Groups E, F, and G hazardous locations.

26.2 Escape Rope.

26.2.1 Escape Rope Design Requirements.

26.2.1.1 Escape rope shall be constructed of virgin fiber.

26.2.1.2 Escape rope shall be of block creel construction.

26.2.1.3 Primary load-bearing elements of escape rope shall be constructed of continuous filament fiber.

26.2.1.4 Where escape rope is a component of equipment with electric-current carrying capabilities, the equipment, including the escape rope, shall meet the requirements of UL 913, *Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, III, Division 1, Hazardous (Classified) Locations*, for Class 1, Division 1, Groups A, B, C, and D and Class II, Division 1, Groups E, F, and G hazardous locations.

26.3 Escape Webbing.

26.3.1 Escape Webbing Design Requirements.

26.3.1.1 Escape webbing shall be constructed of virgin fiber.

26.3.1.2 Escape webbing shall be of block creel construction.

26.3.1.3 Primary load-bearing elements of escape webbing shall be constructed of continuous filament fiber.

26.3.1.4 Where escape webbing is a component of equipment with electric-current carrying capabilities, the equipment, including the escape webbing, shall meet the requirements of UL 913, *Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, III, Division 1, Hazardous (Classified) Locations*, for Class I, Division 1, Groups A, B, C, and D and Class II, Division 1, Groups E, F, and G hazardous locations.

26.4 Fire Escape Rope.

26.4.1 Fire Escape Rope Design Requirements.

26.4.1.1* Fire escape rope shall be constructed of virgin fiber.

26.4.1.2 Fire escape rope shall be of block creel construction.

26.4.1.3 Primary load-bearing elements of fire escape rope shall be constructed of continuous filament fiber.

26.4.1.4 Where fire escape rope is a component of equipment with electric-current carrying capabilities, the equipment, including the fire escape rope, shall meet the requirements of UL 913, *Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, III, Division 1, Hazardous (Classified) Locations*, for Class I, Division 1, Groups A, B, C, and D and Class II, Division 1, Groups E, F, and G hazardous locations.

26.5 Fire Escape Webbing.

26.5.1 Fire Escape Webbing Design Requirements.

26.5.1.1* Fire escape webbing shall be constructed of virgin fiber.

26.5.1.2 Fire escape webbing shall be of block creel construction.

26.5.1.3 Primary load-bearing elements of fire escape webbing shall be constructed of continuous filament fiber.

26.5.1.4 Where fire escape webbing is a component of equipment with electric-current carrying capabilities, the equipment, including the fire escape webbing, shall meet the requirements of UL 913, *Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, II, Division 1, Hazardous (Classified) Locations*, for Class I, Division 1, Groups A, B, C, and D and Class II, Division 1, Groups E, F, and G hazardous locations.

26.6 Throwlines.

26.6.1 Throwline Design Requirements.

26.6.1.1* Throwlines shall be constructed of virgin fiber.

26.6.1.2 Throwlines shall be of block creel construction.

26.6.1.3 Throwline load-bearing elements shall be constructed of continuous filament fiber.

26.7 Moderate Elongation Laid Life-Saving Rope.

26.7.1 Moderate Elongation Laid Life-Saving Rope Design Requirements.

26.7.1.1* Moderate elongation laid life-saving rope shall be constructed of virgin fiber.

26.7.1.2 Moderate elongation laid life-saving rope shall be of block creel construction.

26.7.1.3 Primary load-bearing elements of moderate elongation laid life-saving rope shall be constructed of continuous filament fiber.

26.7.1.4 Where moderate elongation laid life-saving rope is a component of equipment with electric-current carrying capabilities, the equipment, including the moderate elongation laid life-saving rope, shall meet the requirements of UL 913, *Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, III, Division 1, Hazardous (Classified) Locations,* for Class I, Division 1, Groups A, B, C, and D and Class II, Division 1, Groups E, F, and G hazardous locations.

26.8 Manufacturer-Supplied Eye Termination.

26.8.1 Manufacturer-Supplied Eye Termination Design Requirements.

26.8.1.1 Manufacturer-supplied eye terminations shall include life safety rope, escape rope, escape webbing, fire escape rope, fire escape webbing, throwlines, or moderate elongation laid life-saving rope that has been tested to and certified to the requirements specified in Chapters 24 through 28 of this standard.

26.8.1.2 All thread utilized in the construction of manufacturer-supplied eye termination shall allow for ease of inspection by the unaided eye with 20/20 vision or vision corrected to 20/20 at a nominal distance of 305 mm (12 in.).

26.9 Life Safety Harnesses.

26.9.1 Life Safety Harness Design Requirements.

26.9.1.1 Life safety harnesses shall be designed and designated in accordance with the requirements for either Class II or Class III.

26.9.1.1.1 Class II.

26.9.1.1.1.1 A harness that fastens around the waist and around thighs or under buttocks and is designed for rescue

with a design load of 2.67 kN (600 lbf) shall be designated as a Class II life safety harness.

26.9.1.1.1.2 Class II life safety harness shall be permitted to consist of one or more parts.

26.9.1.1.2 Class III.

26.9.1.1.2.1 A harness that fastens around the waist, around thighs, or under buttocks, and over shoulders and is designed for rescue with a design load of 2.67 kN (600 lbf) shall be designated as a Class III life safety harness.

26.9.1.1.2.2 Class III life safety harnesses shall be permitted to consist of one or more parts.

26.9.1.2 Life safety harnesses shall be permitted to be adjustable within a range of sizes, provided in a range of sizes, or custom-fitted for individuals.

26.9.1.3* Load-bearing textile materials used in the construction of life safety harnesses shall be made from virgin, synthetic, continuous-filament fiber.

26.9.1.4* All webbing ends shall be secured by heat sealing or by another method that prevents unraveling.

26.9.1.5* All thread utilized in the construction of life safety harnesses shall allow for ease of inspection by the unaided eye with 20/20 vision or vision corrected to 20/20 at a nominal distance of 305 mm (12 in.). All stitching breaks or ends shall be backtacked not less than 13 mm (½ in.).

26.9.1.6 Life safety harnesses shall have at least one load-bearing attachment point located at the front waist or sternal location of the harness.

26.9.1.7 Load-bearing hardware used in life safety harnesses shall be constructed of forged, machined, stamped, extruded, or cast material.

26.9.1.7.1 Load-bearing areas of cast-metal components shall meet Class I, Grade A requirements of SAE AMS-2175A, *Castings, Classification and Inspection of.*

26.9.1.8 Where a buckle is an integral part of a life safety harness, the buckle manufacturer shall provide written evidence that all load-bearing buckles have been proof-loaded to at least 11 kN (2473 lbf).

26.9.2 Optional Requirements for Flame-Resistant Life Safety Harnesses. Sewing thread utilized in the construction of flame-resistant life safety harnesses shall be made of inherently flame-resistant fiber.

26.10 Belts.

26.10.1 Belt Design Requirements.

26.10.1.1 Belts shall be designed and designated in accordance with one of the types in 26.10.1.1 or 26.10.1.1.2.

26.10.1.1.1 A belt that fastens only around the waist, includes at least one positioning attachment point, and is a positioning device for a person on a ladder shall be designated as a ladder belt.

26.10.1.1.2 A belt that fastens only around the waist, includes at least one load-bearing attachment point, and is intended for use by the wearer as an emergency self-rescue device shall be designated as an escape belt.

26.10.1.2* All belts shall be permitted to be adjustable within a range of sizes, provided in a range of sizes, or custom-fitted for individuals.

26.10.1.3* Load-bearing textile materials used in the construction of all belts shall be made from virgin, synthetic, continuous-filament fiber.

26.10.1.4* All belts shall have webbing ends secured by heat sealing or by another method that prevents unraveling.

26.10.1.5* All thread utilized in the construction of all belts shall allow for ease of inspection by the unaided eye with 20/20 vision, or vision corrected to 20/20, at a nominal distance of 305 mm (12 in.). All stitching breaks or ends shall be backtacked not less than 13 mm (½ in.).

26.10.1.6 Ladder belts shall include a tether or device that connects the wearer to a ladder. The tether or device shall not extend greater than 610 mm (24 in.) in total length, including connection hardware on each end, when measured from the surface of the belt to the inside of the connector device at the greatest distance from the belt.

26.10.1.7 Load-bearing hardware used in belts shall be constructed of forged, machined, stamped, extruded, or cast material.

26.10.1.7.1 Load-bearing areas of cast-metal components shall meet Class I, Grade A requirements of SAE AMS-2175A, *Castings, Classification and Inspection of.*

26.10.1.8 Where a buckle is an integral part of a belt, the buckle manufacturer shall provide written evidence that all load-bearing buckles have been proof-loaded to at least 11 kN (2473 lbf).

26.10.2 Optional Requirements for Flame-Resistant Belts. Sewing thread utilized in the construction of flame-resistant belts shall be made of inherently flame-resistant fiber.

26.11 Victim Extrication Devices.

26.11.1 Victim Extrication Device Design Requirements. Victim extrication devices shall be designed and designated in accordance with the requirements for either Class II or Class III.

26.11.1.1 Class II Victim Extrication Device. A device that secures around the waist and around the thighs or under the buttocks to be used for victim extrication in an upright position shall be designated as a Class II victim extrication device.

26.11.1.2 Class III Victim Extrication Device. A device that secures around the waist, around the thighs, or under the buttocks, and over the shoulders or that otherwise encapsulates a body to be used for victim extrication in an upright or horizontal configuration shall be designated as a Class III victim extrication device.

26.11.2 Victim extrication devices shall be permitted to consist of one or more parts.

26.11.3 Load-bearing textile materials used in the construction of victim extrication devices shall be made from virgin, synthetic, continuous-filament fiber.

26.11.4 All webbing ends shall be secured by heat sealing or by another method that prevents unraveling.

26.11.5 All thread used in the construction of victim extrication devices shall allow for ease of inspection by the unaided eye with 20/20 vision at nominal distance of 305 mm (12 in.). All stitching breaks or ends shall be backtacked not less than 13 mm (½ in.).

26.11.6 Victim extrication devices shall have at least one load-bearing attachment point as identified by manufacturer's instructions.

26.11.7 Load-bearing hardware used in victim extrication devices shall be constructed of forged, machined, stamped, extruded, or cast material.

26.11.7.1 Load-bearing areas of cast-metal components shall meet Class I, Grade A requirements of SAE AMS-2175A, *Castings, Classifications and Inspection of.*

26.11.8 Where a buckle is an integral part of a victim extrication device, the buckle manufacturer shall provide written evidence that all load-bearing buckles have been proof-loaded to at least 11 kN (2473 lbf).

26.12 End-to-End Straps.

26.12.1 End-to-End Strap Design Requirements.

26.12.1.1 End-to-end straps shall not be designed or constructed in a manner that allows self-destructive action.

26.12.1.2 End-to-end straps shall be designated by the manufacturer for their intended use and design load as either technical use or general use.

26.12.1.3 Load-bearing hardware used in end-to-end straps shall be constructed of forged, machined, stamped, extruded, or cast material.

26.12.1.3.1 Load-bearing areas of cast-metal components shall meet Class I, Grade A requirements of SAE AMS-2175A, *Castings, Classification and Inspection of.*

26.12.1.4 Where a buckle is an integral part of the strap, the buckle manufacturer shall provide written evidence that all load-bearing buckles have been proof-loaded to at least 11 kN (2473 lbf).

26.12.1.5 Webbing used to construct strap shall be constructed of virgin, synthetic, continuous filament fiber.

26.12.1.6 All webbing ends used to construct straps shall be secured by heat sealing or by another method that prevents unraveling.

26.12.1.7 All thread utilized to construct straps shall allow for ease of inspection by the unaided eye with 20/20 vision or vision corrected to 20/20 at a nominal distance of 305 mm (12 in.). All stitching breaks or ends shall be backtacked not less than 13 mm (½ in.).

26.13 Multiple Configuration Straps.

26.13.1 Multiple Configuration Strap Design Requirements.

26.13.1.1 Multiple configuration straps shall not be designed or constructed in a manner that allows self-destructive action.

26.13.1.2 Multiple configuration straps shall be designated by the manufacturer for their intended use and design load as either technical use or general use.

26.13.1.3 Load-bearing hardware used in multiple configuration straps shall be constructed of forged, machined, stamped, extruded, or cast material.

26.13.1.3.1 Load-bearing areas of cast-metal components shall meet Class I, Grade A requirements of SAE AMS-2175A, *Castings, Classification and Inspection of.*

26.13.1.4 Where a buckle is an integral part of the strap, the buckle manufacturer shall provide written evidence that all load-bearing buckles have been proof-loaded to at least 11 kN (2473 lbf).

26.13.1.5 Webbing used to construct strap shall be constructed of virgin, synthetic, continuous filament fiber.

26.13.1.6 All webbing ends used to construct straps shall be secured by heat sealing or by another method that prevents unraveling.

26.13.1.7 All thread utilized to construct straps shall allow for ease of inspection by the unaided eye with 20/20 vision or vision corrected to 20/20 at a nominal distance of 305 mm (12 in.). All stitching breaks or ends shall be backtacked not less than 13 mm (½ in.).

26.14 Belay Devices.

26.14.1 Belay Device Design Requirements.

26.14.1.1 Belay devices shall not be designed or constructed in a manner that allows self-destructive action.

26.14.1.2 Belay devices shall be designated by the manufacturer for their intended use and design load as either technical use or general use.

26.14.1.3 Load-bearing hardware used in belay devices shall be constructed of forged, machined, stamped, extruded, or cast material.

26.14.1.3.1 Load-bearing areas of cast-metal components shall meet Class I, Grade A requirements of SAE AMS-2175A, *Castings, Classification and Inspection of.*

26.15 Carabiners and Snap Links.

26.15.1 Carabiner and Snap Link Design Requirements.

26.15.1.1 Carabiners and snap links shall not be designed or constructed in a manner that allows self-destructive action.

26.15.1.2 Carabiners and snap links shall be designated by the manufacturer for their intended use and design load as either technical use or general use.

26.15.1.3 Carabiners and snap-links shall be constructed of forged, machined, stamped, extruded, or cast material.

26.15.1.4 Load-bearing areas of cast-metal components shall meet Class I, Grade A requirements of SAE AMS-2175A, *Castings, Classification and Inspection of.*

26.15.1.5 Snap link and carabiner gates shall be self-closing and of a locking design.

26.16 Descent Control Devices.

26.16.1 Descent Control Device Design Requirements.

26.16.1.1 Descent control devices shall not be designed or constructed in a manner that allows self-destructive action.

26.16.1.2 Descent control devices shall be designated by the manufacturer for its intended use and design load as either escape use, technical use, or general use.

26.16.1.2.1 The designation of escape use shall apply to descent control devices intended for the sole use of the rescuer for personal escape or self-rescue.

26.16.1.3 Descent control devices shall be constructed of forged, machined, stamped, extruded, or cast material.

26.16.1.3.1 Load-bearing areas of cast-metal components shall meet Class I, Grade A requirements of SAE AMS-2175A, *Castings, Classification and Inspection of.*

26.16.1.4 All descent control devices shall be classified by type in accordance with Section 3.2.1 of ISO 22159, *Personal equipment for protection against falls — Descending devices.*

26.17 Escape Anchors.

26.17.1 Escape Anchor Design Requirements.

26.17.1.1 Escape anchors shall not be designed or constructed in a manner that allows self-destructive action.

26.17.1.2 Escape anchors shall be designed for personal escape or self-rescue or for the rescue of a single firefighter.

26.17.1.3 Escape anchors shall be constructed of forged, machined, stamped, extruded, or cast material.

26.17.1.4 Load-bearing areas of cast-metal components shall meet Class I, Grade A requirements of SAE AMS-2175A, *Castings, Classification and Inspection of.*

26.18 Litters.

26.18.1 Litter Design Requirements.

26.18.1.1 Litters shall not be designed or constructed in a manner that allows self-destructive action.

26.18.1.2 Litters designed to split apart shall have an integral connection system.

26.19 Portable Anchors.

26.19.1 Portable Anchor Design Requirements.

26.19.1.1 Portable anchors shall not be designed or constructed in a manner that allows self-destructive action.

26.19.1.2 Portable anchors shall be designated by the manufacturer for their intended use and design load as either technical use or general use.

26.19.1.3 Portable anchors shall be constructed of forged, machined, stamped, extruded, or cast material.

26.19.1.3.1 Load-bearing areas of cast-metal components shall meet Class I, Grade A requirements of SAE AMS-2175A, *Castings, Classification and Inspection of.*

26.20 Pulleys.

26.20.1 Pulley Design Requirements.

26.20.1.1 Pulleys shall not be designed or constructed in a manner that allows self-destructive action.

26.20.1.2 Pulleys shall be designated by the manufacturer for their intended use and design load as either technical use or general use.

26.20.1.3 Pulleys shall be constructed of forged, machined, stamped, extruded, or cast material.

26.20.1.3.1 Load-bearing areas of cast-metal components shall meet Class I, Grade A requirements of SAE AMS-2175A, *Castings, Classification and Inspection of.*

26.21 Rope Grabs and Ascending Devices.

26.21.1 Rope Grab and Ascending Device Design Requirements.

26.21.1.1 Rope grab and ascending devices shall not be designed or constructed in a manner that allows self-destructive action.

26.21.1.2 Rope grab and ascending devices shall be designated by the manufacturer for their intended use and design load as either technical use or general use.

26.21.1.3 Rope grabs and ascending devices shall be constructed of forged, machined, stamped, extruded, or cast material.

26.21.1.3.1 Load-bearing areas of cast-metal components shall meet Class I, Grade A requirements of SAE AMS-2175A, *Castings, Classification and Inspection of.*

26.22 Other Auxiliary Equipment.

26.22.1 Other Auxiliary Equipment Design Requirements.

26.22.1.1 Auxiliary equipment shall not be designed or constructed in a manner that allows self-destructive action.

26.22.1.2 Auxiliary equipment shall be designated by the manufacturer for its intended use and design load as either escape use, technical use, or general use.

26.22.1.2.1 The designation of escape shall apply to auxiliary equipment intended for the sole use of the rescuer for personal escape or self-rescue.

26.22.1.3 Other auxiliary equipment shall be constructed of forged, machined, stamped, extruded, or cast material.

26.22.1.3.1 Load-bearing areas of cast-metal components shall meet Class I, Grade A requirements of SAE AMS-2175A, *Castings, Classification and Inspection of.*

26.22.1.4 Where a buckle is an integral part of an auxiliary equipment system component, the buckle manufacturer shall provide written evidence that all load-bearing buckles have been proof-loaded to at least 11 kN (2473 lbf).

26.22.1.5 Webbing used to construct auxiliary equipment software shall be constructed of virgin, synthetic, continuous-filament fiber.

26.22.1.6* All webbing ends used to construct auxiliary equipment software shall be secured by heat sealing or by another method that prevents unraveling.

26.22.1.7* All thread utilized to construct auxiliary equipment software shall allow for ease of inspection by the unaided eye with 20/20 vision or vision corrected to 20/20 at a nominal distance of 305 mm (12 in.). All stitching breaks or ends shall be backtacked not less than 13 mm (½ in.).

26.23 Escape Systems.

26.23.1 Escape System Design Requirements.

26.23.1.1 The escape system shall be designed for escape or self-rescue.

26.23.1.2 Escape systems shall include the following:

(1) Flexible lifeline, including, but not limited to, rope, webbing, or cable
(2) Descent control device
(3) Connector from the system to the user, not to include the harness
(4) Means of attaching the system to an anchoring point, such as an escape anchor, capable of supporting human loads

26.23.1.3 The individual components of the escape system shall meet the respective design requirements of the individual components as specified in this standard.

26.24 Fire Escape Systems.

26.24.1 Fire Escape System Design Requirements.

26.24.1.1 The fire escape system shall be designed for escape or self-rescue from an immediately hazardous environment involving elevated temperatures.

26.24.1.2 Fire escape systems shall include the following:

(1) A flexible lifeline, including, but not limited to, rope, webbing, or cable
(2) A descent control device
(3) A connector from the system to the user, not to include the harness
(4) A means of attaching the system to an anchoring point, such as an escape anchor, capable of supporting human loads

26.24.1.3 The individual components of the fire escape system shall meet the respective design requirements of the individual components as specified in this standard.

26.25 Manufactured Systems.

26.25.1 Manufactured System Design Requirements.

26.25.1.1 Manufactured systems shall not be designed or constructed in a manner that allows self-destructive action.

26.25.1.2 Manufactured systems shall be designated by the manufacturer for their intended use and design load as either technical use or general use.

26.25.1.3 Load-bearing hardware used in a manufactured system shall be constructed of forged, machined, stamped, extruded, or cast material.

26.25.1.3.1 Load-bearing areas of cast-metal components shall meet Class I, Grade A requirements of SAE AMS-2175A, *Castings, Classification and Inspection of.*

26.25.1.4 Where a buckle is an integral part a manufactured system, the buckle manufacturer shall provide written evidence that all load-bearing buckles have been proof-loaded to at least 11 kN (2473 lbf).

26.25.1.5 Webbing used to construct manufactured system software shall be constructed of virgin, synthetic, continuous filament fiber.

26.25.1.6 All webbing ends used to construct manufactured system software shall be secured by heat sealing or by another method that prevents unraveling.

26.25.1.7 All thread utilized to construct manufactured system software shall allow for ease of inspection by the unaided eye with 20/20 vision or vision corrected to 20/20 at a nominal distance of 305 mm (12 in.). All stitching breaks or ends shall be backtacked not less than 13 mm (½ in.).

26.25.1.8 The individual components of the manufactured system shall meet the respective design requirements of the individual components as specified in this standard.

Chapter 27 Performance Requirements (NFPA 1983)

27.1 Life Safety Rope Performance Requirements.

27.1.1 Technical-use life safety rope shall be tested for breaking strength and elongation as specified in Section 28.2 and shall have a minimum breaking strength of not less than 20 kN (4496 lbf), a minimum elongation that shall not be less than 1 percent at 10 percent of breaking strength, and a maximum elongation that shall not be more than 10 percent at 10 percent of breaking strength.

27.1.2 General-use life safety rope shall be tested for breaking strength and elongation as specified in Section 28.2 and shall have a minimum breaking strength of not less than 40 kN (8992 lbf), a minimum elongation that shall not be less than 1 percent at 10 percent of breaking strength, and a maximum elongation that shall not be more than 10 percent at 10 percent of breaking strength.

27.1.3* Technical-use life safety rope shall be tested for size as specified in Section 7.1 of CI 1800, *Test Methods for Life Safety Rope and Accessory Cords for Life Safety Applications*, and shall have a diameter of 9.5 mm (⅜ in.) or greater but less than or equal to 12.5 mm (½ in.). For reporting purposes, the calculated diameter of all new life safety rope shall be rounded to the nearest 0.5 mm (1/64 in.).

27.1.4* General-use life safety rope shall be tested for size as specified in Section 7.1 of CI 1800, *Test Methods for Life Safety Rope and Accessory Cords for Life Safety Applications*, and shall have a diameter of 11 mm (7/16 in.) or greater but less than or equal to 16 mm (⅝ in.). For reporting purposes, the calculated diameter of life safety rope shall be rounded to the nearest 0.5 mm (1/64 in.).

27.1.5* Fiber utilized for all life safety rope shall be tested for melting as specified in ASTM E794, *Standard Test Method for Melting and Crystallization Temperatures by Thermal Analysis*, and shall have a melting point of not less than 204°C (400°F).

27.1.6 Life safety rope product labels and identification tape shall be tested for legibility as specified in Section 28.10 and shall be legible, shall remain in place, and shall not be torn or otherwise damaged.

27.2* Escape Rope Performance Requirements.

27.2.1 Escape rope shall be tested for breaking strength and elongation as specified in Section 28.2 and shall have a minimum breaking strength of not less than 13.5 kN (3034 lbf), the minimum elongation shall not be less than 1 percent at 10 percent of breaking strength, and the maximum elongation

shall not be more than 10 percent at 10 percent of breaking strength.

27.2.2* Escape rope shall be tested for size as specified in Section 7.1 of CI 1800, *Test Methods for Life Safety Rope and Accessory Cords for Life Safety Applications,* and shall have a diameter of 7.5 mm (19⁄64 in.) or greater but less than or equal to 9.5 mm (3⁄8 in.). For the purpose of reporting, the calculated diameter of escape rope shall be rounded to the nearest 0.5 mm (1⁄64 in.).

27.2.3* Fiber utilized for all escape rope shall be tested for melting in accordance with ASTM E794, *Standard Test Method for Melting and Crystallization Temperatures by Thermal Analysis,* and shall have a melting point of not less than 204°C (400°F).

27.2.4 Escape rope product labels and identification tape shall be tested for legibility as specified in Section 28.10 and shall be legible, shall remain in place, and shall not be torn or otherwise damaged.

27.3 Escape Webbing Performance Requirements.

27.3.1 Escape webbing shall be tested for breaking strength and elongation as specified in Section 28.2 and shall have a minimum breaking strength of not less than 13.5 kN (3034 lbf), the minimum elongation shall not be less than 1 percent at 10 percent of breaking strength, and the maximum elongation shall not be more than 10 percent at 10 percent of breaking strength.

27.3.2 Escape webbing shall be tested for size as specified in Section 7.1 of CI 1800, *Test Methods for Life Safety Rope and Accessory Cords for Life Safety Applications,* and shall have a minimum perimeter of 25 mm (1 in.). For the purpose of reporting, the perimeter of all new escape webbing shall be rounded to the nearest 0.5 mm (1⁄64 in.).

27.3.3 Fiber utilized for all escape webbing shall be tested for melting in accordance with ASTM E794, *Standard Test Method for Melting and Crystallization Temperatures by Thermal Analysis,* and shall have a melting point of not less than 204°C (400°F).

27.3.4 Escape webbing product labels and identification tape shall be tested for legibility as specified in Section 28.10 and shall be legible, shall remain in place, and shall not be torn or otherwise damaged.

27.4* Fire Escape Rope Performance Requirements.

27.4.1 Fire escape rope shall be tested for breaking strength and elongation as specified in Section 28.2 and shall have a minimum breaking strength of not less than 13.5 kN (3034 lbf); the minimum elongation shall not be less than 1 percent at 10 percent of breaking strength; and the maximum elongation shall not be more than 10 percent at 10 percent of breaking strength.

27.4.2* Fire escape rope shall be tested for size as specified in Section 7.1 of CI 1800, *Test Methods for Life Safety Rope and Accessory Cords for Life Safety Applications*, and shall have a diameter of at least 7.5 mm (19⁄64 in.) but less than or equal to 9.5 mm (3⁄8 in.). For the purpose of reporting, the calculated diameter of fire escape rope shall be rounded to the nearest 0.5 mm (1⁄64 in.).

27.4.3* Fiber utilized for all fire escape rope shall be tested for melting in accordance with ASTM E794, *Standard Test Method for Melting and Crystallization Temperatures by Thermal Analysis*, and shall have a melting point of not less than 260°C (500°F).

27.4.4 Fire escape rope product labels and identification tape shall be tested for legibility as specified in Section 28.10 and shall be legible, shall remain in place, and shall not be torn or otherwise damaged.

27.4.5 Fire escape rope shall be tested for high-temperature exposure as specified in Section 28.15. This test shall be conducted at two independent conditions and shall have a minimum time to failure of 45 seconds at 600°C (1112°F) while holding 1.33 kN (300 lb) and of 5 minutes at 400°C (752°F) while holding 1.33 kN (300 lb).

27.5 Fire Escape Webbing Performance Requirements.

27.5.1 Fire escape webbing shall be tested for breaking strength and elongation as specified in Section 28.2 and shall have a minimum breaking strength of not less than 13.5 kN (3034 lbf), the minimum elongation shall not be less than 1 percent at 10 percent of breaking strength, and the maximum elongation shall not be more than 10 percent at 10 percent of breaking strength.

27.5.2 Fire escape webbing shall be tested for size as specified in Section 7.1 of CI 1800, *Test Methods for Life Safety Rope and Accessory Cords for Life Safety Applications*, and shall have a minimum perimeter of 25 mm (1 in.). For the purpose of reporting, the perimeter of escape webbing shall be rounded to the nearest ½ mm (1⁄64 in.).

27.5.3 Fiber utilized for all fire escape webbing shall be tested for melting in accordance with ASTM E794, *Standard Test Method for Melting and Crystallization Temperatures by Thermal Analysis*, and shall have a melting point of not less than 260°C (500°F).

27.5.4 Fire escape webbing shall be tested for high temperature exposure as specified in Section 28.15. This test shall be conducted at two independent conditions and shall have a minimum time to failure of 45 seconds at 600°C (1112°F) while holding 1.33 kN (300 lb) and of 5 minutes at 400°C (752°F) while holding 1.33 kN (300 lb).

27.5.5 Fire escape webbing product labels and identification tape shall be tested for durability as specified in Section 28.10 and shall be legible, shall remain in place, and shall not be torn or otherwise damaged.

27.6 Throwline Performance Requirements.

27.6.1 Throwline shall be tested for minimum breaking strength as specified in Section 28.2 and shall have a minimum breaking strength of not less than 13 kN (2923 lbf).

27.6.2* Throwlines shall be tested for size as specified in Section 7.1 of CI 1800, *Test Methods for Life Safety Rope and Accessory Cords for Life Safety Applications*, and shall have a diameter of 7 mm (19⁄64 in.) or greater but less than or equal to 9.5 mm (3⁄8 in.). For the purpose of reporting, the calculated diameter of throwlines shall be rounded to the nearest 0.5 mm (1⁄64 in.).

27.6.3 Throwlines shall be tested for the ability to float as specified in Section 28.9 and shall float.

27.6.4 Throwlines product labels and identification tape shall be tested for legibility as specified in Section 28.10 and shall remain in place and shall be legible.

27.7 Moderate Elongation Laid Life-Saving Rope Performance Requirements.

27.7.1 Moderate elongation laid life-saving rope shall be tested for breaking strength and elongation as specified in Section 28.2 and shall have a minimum breaking strength of not less than 40 kN (8992 lbf); the minimum elongation shall not be less than 1 percent at 10 percent of breaking strength and the maximum elongation shall not be more than 25 percent at 10 percent of breaking strength.

27.7.2 Moderate elongation laid life-saving rope shall be tested for size as specified in Section 29.1 of CI 1805, *3-Strand Life Safety Rope, Moderate Stretch,* and shall have a diameter of 11 mm (7/16 in.) or greater but less than or equal to 16 mm (5/8 in.). For the purpose of reporting, the calculated diameter of moderate elongation life-saving rope shall be rounded to the nearest 0.5 mm (1/64 in.).

27.7.3* Fiber utilized for all moderate elongation laid life-saving rope shall be tested for melting as specified in ASTM E794, *Standard Test Method for Melting and Crystallization Temperatures by Thermal Analysis,* and shall have a melting point of not less than 204°C (400°F).

27.7.4 Moderate elongation laid life-saving rope product labels and identification tape shall be tested for legibility as specified in Section 28.10 and shall be legible, shall remain in place, and shall not be torn or otherwise damaged.

27.8 Manufacturer-Supplied Eye Termination Performance Requirements.

27.8.1* Manufacturer-supplied eye termination shall be tested for breaking strength as specified in Section 28.2 and shall meet one of the following criteria:

(1) It shall have a minimum breaking strength of not less than 17 kN (3822 lbf) for technical use life safety rope.
(2) It shall have a minimum breaking strength of not less than 34 kN (7644 lbf) for general use life safety rope and moderate elongation laid life-saving rope.
(3) It shall have a minimum breaking strength of not less than 11.5 kN (2585 lbf) for escape rope and fire escape rope.
(4) It shall have a minimum breaking strength of not less than 11.5 kN (2585 lbf) for escape webbing and fire escape webbing.
(5) It shall have a minimum breaking strength of not less than 11 kN (2473 lbf) for throwline.

27.8.2 All thread used in the construction of manufacturer-supplied eye termination, except for fire escape rope and fire escape webbing, shall be tested for melting as specified in ASTM E794, *Standard Test Method for Melting and Crystallization Temperatures by Thermal Analysis*, and shall have a melting point of not less than 204°C (400°F).

27.8.2.1 All thread used in the construction of manufacturer-supplied eye terminations for fire escape rope or fire escape webbing shall be tested for melting as specified in ASTM E794, *Standard Test Method for Melting and Crystallization Temperatures by Thermal Analysis*, and shall have a melting point of not less than 260°C (500°F).

27.8.3 All metal hardware and hardware that includes metal parts shall be tested for corrosion resistance as specified in Section 28.8 and metals inherently resistant to corrosion, including but not limited to stainless steel, brass, copper, aluminum, and zinc shall show no more than light surface–type corrosion or oxidation. Ferrous metals shall show no corrosion of the base metal. All hardware shall remain functional as specified in the manufacturer's operating instructions.

27.8.4 Manufacturer-supplied eye termination for fire escape rope and fire escape webbing shall be tested for high-temperature exposure as specified in Section 28.15. This test shall be conducted at two independent conditions and shall have a minimum time to failure of 45 seconds at 600°C (1112°F) while holding 1.33 kN (300 lb) and 5 minutes at 400°C (752°F) while holding 1.33 kN (300 lb).

27.9 Life Safety Harness Performance Requirements.

27.9.1 Class II Life Safety Harnesses.

27.9.1.1 Class II life safety harnesses shall be tested for strength as specified in Section 28.3.

27.9.1.1.1 Class II life safety harnesses shall not release from the test torso.

27.9.1.1.2 Class II life safety harness buckles and adjusting devices shall not slip more than 25 mm (1 in.).

27.9.1.1.2.1 When the webbing slips at an angle, each edge of the webbing shall be measured and the average of the measurements shall not be more than 25 mm (1 in.).

27.9.1.1.3 Harness webbing shall show no visible signs of damage that would affect its function.

27.9.1.2 Class II life safety harnesses shall be tested for drop as specified in Section 28.4 and the test torso shall not contact the ground during any of the test drops.

27.9.1.3 Where Class II life safety harnesses include side D-rings and attachment points designated by the manufacturer as positioning attachments only, these attachments shall be tested for strength as specified in Section 28.3 and shall show no visible signs of damage that would affect its function.

27.9.2 Class III Life Safety Harnesses.

27.9.2.1 Class III life safety harnesses shall be tested for strength as specified in Section 28.3.

27.9.2.1.1 Class III life safety harnesses shall not release from the test torso.

27.9.2.1.2 Class III life safety harness buckles and adjusting devices shall not slip more than 25 mm (1 in.).

27.9.2.1.2.1 When the webbing slips at an angle, each edge of the webbing shall be measured and the average of the measurements shall not be more than 25 mm (1 in.).

27.9.2.1.3 Harness webbing shall show no visible signs of damage that would affect its function.

27.9.2.2 Class III life safety harnesses shall be tested for drop as specified in Section 28.4 and the test torso shall not contact the ground during any of the test drops.

27.9.2.3 Where Class III life safety harnesses include side D-rings and attachment points designated by the manufacturer as positioning attachments only, these attachments shall be tested for strength as specified in Section 28.3 and shall show no visible signs of damage that would affect its function.

27.9.3 All life safety harnesses product labels shall be tested for durability as specified in Section 28.10 and shall be legible, and shall not be torn or otherwise damaged.

27.9.4 All metal hardware and hardware that includes metal parts shall be tested for corrosion resistance as specified in Section 28.8 and metals inherently resistant to corrosion including but not limited to stainless steel, brass, copper, aluminum, and zinc shall show no more than light surface–type corrosion or oxidation. Ferrous metals shall show no corrosion of the base metal. All hardware shall remain functional as specified in the manufacturers' operating instructions.

27.9.5* All fiber and thread used in load-bearing materials and thread used in the construction of Class II and Class III life safety harness shall be tested for melting as specified in ASTM E794, *Standard Test Method for Melting and Crystallization Temperatures by Thermal Analysis,* and shall have a melting point of not less than 204°C (400°F).

27.9.6 Optional Requirements for Flame-Resistant Life Safety Harnesses.

27.9.6.1 Where harnesses are represented as being flame-resistant, materials shall be tested individually for flame resistance as specified in Section 28.16 and shall have an average char length of not more than 100 mm (4 in.), shall have an average afterflame of not more than 2.0 seconds, and shall not melt or drip.

27.9.6.2 Where harnesses are represented as being flame-resistant, materials, labels, and hardware shall be tested individually for heat resistance as specified in Section 28.16 and shall not melt, drip, separate, or ignite; hardware items shall remain functional.

27.9.6.3 Where harnesses are represented as being flame-resistant, all fiber and sewing thread utilized in the construction of harnesses shall be tested for melting as specified in ASTM D7138, *Standard Test Method to Determine Melting Temperature of Synthetic Fibers*, Method 1, and shall have a melting point of not less than 260°C (500°F).

27.10 Belt Performance Requirements.

27.10.1 Ladder belts shall be tested for strength as specified in Section 28.3.

27.10.1.1 Ladder belts shall not release from the test torso.

27.10.1.2 Ladder belt buckles and adjusting devices shall not slip more than 25 mm (1 in.).

27.10.1.2.1 When the webbing slips at an angle, each edge of the webbing shall be measured and the average of the measurements shall not be more than 25 mm (1 in.).

27.10.1.3 Belt webbing shall show no visible signs of damage that would affect its function.

27.10.1.4 Where ladder belts include side D-rings and attachment points designated by the manufacturer as positioning attachments only, these attachments shall be tested for strength as specified in Section 28.3 and shall show no visible signs of damage that would affect their function.

27.10.2 Escape belts shall be tested for strength as specified in Section 28.3.

27.10.2.1 Escape belts shall not release from the test torso.

27.10.2.2 Escape belt buckles and adjusting devices shall not slip more than 25 mm (1 in.).

27.10.2.2.1 When the webbing slips at an angle, each edge of the webbing shall be measured and the average of the measurements shall not be more than 25 mm (1 in.).

27.10.2.3 Belt webbing shall show no visible signs of damage that would affect its function.

27.10.2.4 Where escape belts include side D-rings and attachment points designated by the manufacturer as positioning attachments only, these attachments shall be tested for strength as specified in Section 28.3 and shall show no visible signs of damage that would affect their function.

27.10.3 Escape belts shall be tested for drop as specified in Section 28.4 and the test torso shall not contact the ground during any of the test drops.

27.10.4 All belt product labels shall be tested for durability as specified in Section 28.10 shall be legible, and shall not be torn or otherwise damaged.

27.10.5 Metal hardware and hardware that includes metal parts shall be tested for corrosion resistance as specified in Section 28.8 and metals inherently resistant to corrosion including but not limited to stainless steel, brass, copper, aluminum, and zinc shall show no more than light surface–type corrosion or oxidation. Ferrous metals shall show no corrosion of the base metal. All hardware shall remain functional as specified in the manufacturer's operating instructions.

27.10.6 All fiber and thread used in load-bearing materials and thread used in the construction of belts shall be tested for melting as specified in ASTM E794, *Standard Test Method for Melting and Crystallization Temperatures by Thermal Analysis*, and shall have a melting point of not less than 204°C (400°F).

27.10.7 Optional Requirements for Flame-Resistant Belts.

27.10.7.1 Where belts are represented as being flame-resistant, materials shall be tested individually for flame resistance as specified in Section 28.16 and shall have an average char length of not more than 100 mm (4 in.), shall have an average afterflame of not more than 2.0 seconds, and shall not melt or drip.

27.10.7.2 Where belts are represented as being flame-resistant, materials, labels, and hardware shall be tested individually for heat resistance as specified in Section 28.17 and shall not melt, drip, separate, or ignite; and hardware items shall not ignite and shall remain functional.

27.10.7.3 Where belts are represented as being flame-resistant, all fiber and sewing thread utilized in the construction of belts shall be tested for melting as specified in ASTM D7138, *Standard Test Method to Determine Melting Temperature of Synthetic Fibers*, Method 1, and shall have a melting point of not less than 260°C (500°F).

27.11 Victim Extrication Device Performance Requirements.

27.11.1 Class II Victim Extrication Devices.

27.11.1.1 Class II victim extrication devices shall be tested for strength as specified in Section 28.3 and shall not release the test torso. The device buckles and adjusting devices shall not slip more than 25 mm (1 in.), and the device shall show no visible signs of damage that would affect its function.

27.11.1.1.1 When the webbing slips at an angle, each edge of the webbing shall be measured and the average of the measurements shall not be more than 25 mm (1 in.).

27.11.1.2 Where Class II victim extrication devices include alternate D-rings and attachment points designated by the manufacturer as alternate lifting points or configurations, these attachments shall be tested for strength as specified as in Section 28.3 and shall show no visual signs of damage that would affect its function.

27.11.2 Class III Victim Extrication Devices.

27.11.2.1 Class III victim extrication devices shall be tested for strength as specified in Section 28.3 and shall not release the test torso. The device buckles and adjusting devices shall not slip more than 25 mm (1 in.), and the device shall show no visible signs of damage that would affect its function.

27.11.2.1.1 When the webbing slips at an angle, each edge of the webbing shall be measured and the average of the measurements shall not be more than 25 mm (1 in.).

27.11.2.2 Where Class III victim extrication devices include alternate D-rings and attachment points designated by the manufacturer as alternate lifting points or configurations, these attachments shall be tested for strength as specified as in Section 28.3 and shall show no visual signs of damage that would affect its function.

27.11.3 All victim extrication device product labels shall be tested for durability as specified in Section 28.10 and shall be legible and shall not be torn or otherwise damaged.

27.11.4 All metal hardware and hardware that includes metal parts shall be tested for corrosion resistance as specified in Section 28.8 and metals inherently resistant to corrosion, including but not limited to stainless steel, brass, copper, aluminum, and zinc, shall show no more than light surface-type corrosion or oxidation. Ferrous metals shall show no corrosion of the base metal. All hardware shall remain functional as specified in the manufacturer's operating instructions.

27.11.5 All fiber used in load-bearing materials and thread used in the construction of Class II and Class III victim extrication devices shall be tested for melting as specified ASTM E794, *Standard Test Method for Melting and Crystallization Temperatures by Thermal Analysis,* and shall have a melting point of not less than 204°C (400°F).

27.12 End-to-End Strap Performance Requirements.

27.12.1 Technical use end-to-end straps shall be tested for breaking strength as specified in Section 28.7 and shall have a minimum breaking strength of at least 11 kN (2473 lbf) without failure.

27.12.1.1 Where the strap includes an adjustment device, the adjustment device shall not slip more than 50 mm (2 in.).

27.12.2 General use end-to-end straps shall be tested for breaking strength as specified Section 28.7 and shall have a minimum breaking strength of at least 22 kN (4946 lbf) without failure.

27.12.2.1 Where the strap includes an adjustment device, the adjustment device shall not slip more than 50 mm (2 in.).

27.12.3 Permanently attached end-to-end strap product labels shall be tested for legibility as specified in Section 28.10, and shall be legible, and shall not be torn or otherwise damaged.

27.12.4 All metal hardware and hardware that includes metal parts shall be tested for corrosion resistance as specified in Section 28.8 and metals inherently resistant to corrosion including but not limited to stainless steel, brass, copper, aluminum, and zinc shall show no more than light surface–type corrosion or oxidation. Ferrous metals shall show no corrosion of the base metal. All hardware shall remain functional as specified in the manufacturer's operating instructions.

27.12.5* All fiber and thread used for end-to-end straps shall be tested for melting as specified in ASTM E794, *Standard Test Method for Melting and Crystallization Temperatures by Thermal Analysis,* and shall have a melting point of not less than 204°C (400°F).

27.13 Multiple Configuration Strap Performance Requirements.

27.13.1 Technical use multiple configuration straps shall be tested for breaking strength as specified in Section 28.7 and shall have a minimum breaking strength of at least 22 kN (4946 lbf) without failure.

27.13.1.1 Where the strap includes an adjustment device, the adjustment device shall not slip more than 50 mm (2 in.).

27.13.2 General use multiple configuration straps shall be tested for breaking strength as specified in Section 28.7 and shall have a minimum breaking strength of at least 45 kN (10,120 lbf) without failure.

27.13.2.1 Where the strap includes an adjustment device the adjustment device shall not slip more than 50 mm (2 in.).

27.13.3 Permanently attached multiple configuration strap product labels shall be tested for legibility as specified in Section 28.10, and shall be legible, and shall not be torn or otherwise damaged.

27.13.4 All metal hardware and hardware that includes metal parts shall be tested for corrosion resistance as specified in Section 28.8 and metals inherently resistant to corrosion including but not limited to stainless steel, brass, copper, aluminum, and zinc shall show no more than light surface–type corrosion or oxidation. Ferrous metals shall show no corrosion of the base metal. All hardware shall remain functional as specified in the manufacturer's operating instructions.

27.13.5 All fiber and thread used for multiple configuration straps shall be tested for melting as specified in ASTM E794, *Standard Test Method for Melting and Crystallization Temperatures by Thermal Analysis,* and shall have a melting point of not less than 204°C (400°F).

27.14 Belay Device Performance Requirements.

27.14.1 Technical use belay devices shall be tested for manner of function as specified in Section 28.6 without failure of the device or failure of the rope, with a belay system extension of less than 1 m (3.28 ft), and with an impact force of less than 15 kN (3372 lbf).

27.14.2 General use belay devices shall be tested for manner of function as specified in Section 28.6 without failure of the device or failure of the rope, with a belay system extension of

less than 1 m (3.28 ft), and with an impact force of less than 15 kN (3372 lbf).

27.14.3 All metal hardware and hardware that includes metal parts shall be tested for corrosion resistance as specified in Section 28.8 and metals inherently resistant to corrosion including but not limited to stainless steel, brass, copper, aluminum, and zinc shall show no more than light surface–type corrosion or oxidation. Ferrous metals shall show no corrosion of the base metal. All hardware shall remain functional as specified in the manufacturer's operating instructions.

27.14.4 All belay device product labels shall be tested for legibility as specified in Section 28.10, shall be legible, and shall not be torn or otherwise damaged.

27.15 Carabiner and Snap-Link Performance Requirements.

27.15.1 Technical use carabiners and snap-links shall be tested for strength as specified in Section 28.5, and shall, with the gate closed, have a major axis minimum breaking strength of at least 22 kN (4946 lbf).

27.15.2 Technical use carabiners and snap-links shall be tested for strength as specified in Section 28.5 and shall, with the gate open, have a major axis minimum breaking strength of at least 7 kN (1574 lbf).

27.15.3 Technical use carabiners and snap-links shall be tested for strength as specified in Section 28.5 and shall have a minor axis minimum breaking strength of at least 7 kN (1574 lbf).

27.15.4 General use carabiners and snap-links shall be tested for breaking strength as specified in Section 28.5 and shall, with the gate closed, have a major axis minimum breaking strength of at least 40 kN (8992 lbf).

27.15.5 General use carabiners and snap-links shall be tested for breaking strength as specified in Section 28.5, and shall, with the gate open, have a major axis minimum breaking strength of at least 11 kN (2473 lbf).

27.15.6 General use carabiners and snap-links shall be tested for breaking strength as specified in Section 28.5 and shall have a minor axis minimum breaking strength of at least 11 kN (2473 lbf).

27.15.7 Permanently attached carabiner and snap-link product labels shall be tested for legibility as specified in Section 28.10 and shall be legible, and shall not be torn or otherwise damaged.

27.15.8 All metal hardware and hardware that includes metal parts shall be tested for corrosion resistance as specified in Section 28.8 and metals inherently resistant to corrosion including but not limited to stainless steel, brass, copper, aluminum, and zinc shall show no more than light surface–type corrosion or oxidation. Ferrous metals shall show no corrosion of the base metal. All hardware shall remain functional as specified in the manufacturers' operating instructions.

27.16 Descent Control Device Performance Requirements.

27.16.1 Escape descent control devices shall be tested for deformation as specified in Section 28.6 and shall show no permanent damage or visible deformation to the general shape of the device or damage to the rope.

27.16.2 Escape descent control devices shall be tested for maximum impact force as specified in Section 28.14 and shall have the maximum impact force not exceed 8 kN (1798 lbf), shall not damage the device or rope, and shall remain functional.

27.16.3 Technical use descent control devices shall be tested for deformation as specified in Section 28.6 and shall show no permanent damage or visible deformation to the general shape of the device or damage to the rope.

27.16.4 General use descent control devices shall be tested for deformation as specified in Section 28.6 and shall show no permanent damage or visible deformation to the general shape of the device or damage to the rope.

27.16.5 ISO 22159, *Personal equipment for protection against falls — Descending devices*, Type 2, Type 3, and Type 4 descent control devices with a hands-free locking element shall be tested in accordance with Section 28.11 and shall meet the requirements in 4.6.1 of ISO 22159.

27.16.5.1 ISO 22159, *Personal equipment for protection against falls — Descending devices*, Type 2 and Type 3 descent control devices with a panic-locking element shall be tested in accordance with Section 28.11, and shall meet the requirements in 4.6.2 of ISO 22159.

27.16.5.2 ISO 22159, *Personal equipment for protection against falls — Descending devices*, Type 5 and Type 6 descent control devices shall be tested in accordance with Section 28.11 and shall meet the requirements in 4.6.3 of ISO 22159.

27.16.6 Permanently attached descent control device product labels shall be tested for legibility as specified in Section 28.10 and shall be legible, and shall not be torn or otherwise damaged.

27.16.7 All metal hardware and hardware that includes metal parts shall be tested for corrosion resistance as specified in Section 28.8 and metals inherently resistant to corrosion including but not limited to stainless steel, brass, copper, aluminum, and zinc shall show no more than light surface–type corrosion or oxidation. Ferrous metals shall show no corrosion of the base metal. All hardware shall remain functional as specified in the manufacturer's operating instructions.

27.17 Escape Anchor Device Performance Requirements.

27.17.1 Escape anchor devices shall be tested for strength as specified in Section 28.7 and shall have a minimum tensile strength of at least 13.5 kN (3034 lbf).

27.17.2 Permanently attached escape anchor device product labels shall be tested for legibility as specified in Section 28.10 shall be legible, and shall not be torn or otherwise damaged.

27.17.3 All metal hardware and hardware that includes metal parts shall be tested for corrosion resistance as specified in Section 28.8 and metals inherently resistant to corrosion including but not limited to stainless steel, brass, copper, aluminum, and zinc shall show no more than light surface–type corrosion or oxidation. Ferrous metals shall show no corrosion of the base metal. All hardware shall remain functional as specified in the manufacturer's operating instructions.

27.17.4 Escape anchor devices constructed of nonmetallic materials shall be tested for heat resistance as specified in Section 28.17 and shall not melt, drip, separate, or ignite; hardware items shall remain functional.

27.18 Litter Performance Requirements.

27.18.1 Litters shall be tested for strength and deformation as specified in Section 28.12 and shall withstand a minimum load of 11 kN (2473 lbf) without failure or deformation of the structural element of more than 50 mm ± 5 mm (2 in. ± 0.2 in.).

27.18.2 All litter product labels shall be tested for legibility as specified in Section 28.10 shall be legible, and shall not be torn or otherwise damaged.

27.18.3 All fiber and thread used in load-bearing materials and threads used in the construction of litters shall be tested for melting as specified in ASTM E794, *Standard Test Method for Melting and Crystallization Temperatures by Thermal Analysis*, and shall have a melting point of not less than 204°C (400°F).

27.19 Portable Anchor Performance Requirements.

27.19.1 Technical use portable anchor devices shall be tested for deformation as specified in Section 28.7 and all adjustments or moving parts shall remain functional, and shall exhibit no condition that would cause the safety of the user to be compromised.

27.19.2 General use portable anchor devices shall be tested for deformation as specified in Section 28.7 and all adjustments or moving parts shall remain functional, and shall exhibit no condition that would cause the safety of the user to be compromised.

27.19.3 Technical use portable anchor devices shall be tested for strength as specified in Section 28.7 and shall withstand a minimum load of at least 18 kN (4046 lbf) without failure.

27.19.4 General use portable anchor devices shall be tested for strength as specified in Section 28.7 and shall withstand a minimum load of at least 36 kN (8093 lbf) without failure.

27.19.5 Permanently attached portable anchor product labels shall be tested for legibility as specified in Section 28.10 shall be legible, and shall not be torn or otherwise damaged.

27.19.6 All metal hardware and hardware that includes metal parts shall be tested for corrosion resistance as specified in Section 28.8 and metals inherently resistant to corrosion including but not limited to stainless steel, brass, copper, aluminum, and zinc shall show no more than light surface–type corrosion or oxidation. Ferrous metals shall show no corrosion of the base metal. All hardware shall remain functional as specified in the manufacturer's operating instructions.

27.20 Pulley Performance Requirements.

27.20.1 Technical use pulleys shall be tested for deformation as specified in Section 28.7 and shall show no permanent damage to the device or damage to the rope.

27.20.2 Technical use pulleys shall be tested for strength as specified in Section 28.7 and shall have a minimum tensile strength of at least 18 kN (4046 lbf) without failure.

27.20.3 General use pulleys shall be tested for deformation as specified in Section 28.7 and shall show no permanent damage to the device or damage to the rope.

27.20.4 General use pulleys shall be tested for strength as specified in Section 28.7 and shall have a minimum tensile strength of at least 36 kN (8093 lbf) without failure.

27.20.5 The becket on technical use pulleys shall be tested for strength as specified in Section 28.7 and shall have a minimum tensile strength of at least 11 kN (2473 lbf) without failure.

27.20.6 The becket on general use pulleys shall be tested for strength as specified in Section 28.7 and shall have a minimum tensile strength of at least 22 kN (4946 lbf) without failure.

27.20.7 Permanently attached pulley product labels shall be tested for legibility as specified in Section 28.10 and shall be legible, and shall not be torn or otherwise damaged.

27.20.8 All metal hardware and hardware that includes metal parts shall be tested for corrosion resistance as specified in Section 28.8 and metals inherently resistant to corrosion including but not limited to stainless steel, brass, copper, aluminum, and zinc shall show no more than light surface–type corrosion or oxidation. Ferrous metals shall show no corrosion of the base metal. All hardware shall remain functional as specified in the manufacturer's operating instructions.

27.21 Rope Grab and Ascending Device Performance Requirements.

27.21.1 Technical use rope grab and ascending devices shall be tested for deformation as specified in Section 28.6 and shall show no permanent damage to the device or damage to the rope.

27.21.2 General use rope grab and ascending devices shall be tested for deformation as specified in Section 28.6 and shall show no permanent damage to the device or damage to the rope.

27.21.3 Permanently attached rope grab and ascending device product labels shall be tested for legibility as specified in Section 28.10 and shall be legible, and shall not be torn or otherwise damaged.

27.21.4 All metal hardware and hardware that includes metal parts shall be tested for corrosion resistance as specified in Section 28.8 and metals inherently resistant to corrosion including but not limited to stainless steel, brass, copper, aluminum, and zinc shall show no more than light surface–type corrosion or oxidation. Ferrous metals shall show no corrosion of the base metal. All hardware shall remain functional as specified in the manufacturer's operating instructions.

27.22 Other Auxiliary Equipment Performance Requirements.

27.22.1 Other technical use auxiliary equipment shall be tested for strength as specified in Section 28.7, and shall have a minimum tensile strength of at least 22 kN (4946 lbf) without failure.

27.22.2 Other general use auxiliary equipment shall be tested for strength as specified in Section 28.7 and shall have a minimum tensile strength of at least 36 kN (8093 lbf).

27.22.3 All metal hardware and hardware that includes metal parts shall be tested for corrosion resistance as specified in Section 28.8, and metals inherently resistant to corrosion including but not limited to stainless steel, brass, copper, aluminum, and zinc shall show no more than light surface–type corrosion or oxidation. Ferrous metals shall show no corrosion of the base metal. All hardware shall remain functional as specified in the manufacturer's operating instructions.

27.22.4* All fiber and thread utilized in the construction of all auxiliary equipment systems and system components shall be

tested for melting as specified in ASTM E794, *Standard Test Method for Melting and Crystallization Temperatures by Thermal Analysis*, and shall have a melting point of not less than 204°C (400°F).

27.22.5 All auxiliary equipment systems and system component product labels shall be tested for legibility as specified in Section 28.10 shall be legible, and shall not be torn or otherwise damaged.

27.23 Escape System Performance Requirements.

27.23.1 Escape systems shall be tested for strength as specified in Section 28.7 and shall have a minimum tensile strength of at least 13.5 kN (3034 lbf) without failure.

27.23.2 All metal hardware and hardware that includes metal parts shall be tested for corrosion resistance as specified in Section 28.8, and metals inherently resistant to corrosion including but not limited to stainless steel, brass, copper, aluminum, and zinc shall show no more than light surface-type corrosion or oxidation. Ferrous metals shall show no corrosion of the base metal. All hardware shall remain functional as specified in the manufacturer's operating instructions.

27.23.3 All fiber and thread used in the construction of the escape systems and system components shall be tested for melting as specified in ASTM E794, *Standard Test Method for Melting and Crystallization Temperatures by Thermal Analysis,* and shall have a melting point of not less than 204°C (400°F).

27.23.4 All escape system equipment and system component product labels shall be tested for legibility as specified in Section 28.10, and shall be legible, and shall not be torn or otherwise damaged.

27.23.5 Where the escape descent control device used in the escape system incorporates a passive or active breaking feature that creates friction between the device and the rope, the system shall be tested for average payout force as specified in Section 28.13 and shall not exceed 90 N (20 lbf).

27.23.6 Escape systems shall be tested for maximum impact force as specified in Section 28.14 and shall have the maximum impact force not exceed 8.0 kN (1798 lbf), shall not damage the rope or device, and shall remain functional.

27.23.7 Escape anchors used in escape systems shall be tested for breaking strength as specified in Section 28.7 for escape anchors and shall have a minimum breaking strength of at least 13.5 kN (3034 lbf).

27.24 Fire Escape System Performance Requirements.

27.24.1 Fire escape systems shall be tested for strength as specified in Section 28.7 and shall have a minimum tensile strength of at least 13.5 kN (3034 lbf) without failure.

27.24.2 All metal hardware and hardware that includes metal parts shall be tested for corrosion resistance as specified in Section 28.8, and metals inherently resistant to corrosion including but not limited to stainless steel, brass, copper, aluminum, and zinc shall show no more than light surface-type corrosion or oxidation. Ferrous metals shall show no corrosion of the base metal. All hardware shall remain functional as specified in the manufacturer's operating instructions.

27.24.3 All escape system equipment and system component product labels shall be tested for legibility as specified in Section 28.10, and shall be legible, and shall not be torn or otherwise damaged.

27.24.4 Where the escape descent control device used in the fire escape system incorporates a passive or active breaking feature that creates friction between the device and the rope, the system shall be tested for average payout force as specified in Section 28.13 and shall not exceed 90 N (20 lbf).

27.24.5 The fire escape lifeline and the manufacturer-supplied eye termination with fire escape lifeline shall be tested for high-temperature exposure as specified in Section 28.15. This test shall be conducted at two independent conditions and shall have a minimum time to failure of 45 seconds at 600°C (1112°F) while holding 136 kg (300 lb) and of 5 minutes at 400°C (752°F) while holding 136 kg (300 lb).

27.24.6 Fire escape system materials, labels, and hardware shall be tested individually for heat resistance as specified in Section 28.17 and shall not melt, drip, separate, or ignite; hardware items shall remain functional.

27.24.7 All fiber and sewing thread used in the construction of fire escape systems shall be tested for melting as specified in ASTM D7138, *Standard Test Method to Determine Melting Temperature of Synthetic Fibers*, Method 1, and shall have a melting point of not less than 260°C (500°F).

27.24.8 Fire escape systems shall be tested for maximum impact force as specified in Section 28.14 and shall have the maximum impact force not exceed 8.0 kN (1798 lbf), shall not damage the rope or device, and shall remain functional.

27.24.9 Escape anchors used in fire escape systems shall be tested for breaking strength as specified in Section 28.7 for escape anchors and shall have a minimum breaking strength of at least 13.5 kN (3034 lbf).

27.25 Manufactured System Performance Requirements.

27.25.1 Technical use manufactured systems shall be tested for deformation as specified in Section 28.7 and shall have no permanent damage to the system or its component parts or visible deformation to the general shape of the system or components.

27.25.2 Technical use manufactured systems shall be tested for strength as specified in Section 28.7 and shall have a minimum tensile strength of at least 18 kN (4046 lbf) without failure.

27.25.3 General use manufactured systems shall be tested for deformation as specified in Section 28.7 and shall have no permanent damage to the system or its component parts or visible deformation to the general shape of the system or components.

27.25.4 General use manufactured systems shall be tested for strength as specified in Section 28.7 and shall have a minimum tensile strength of at least 36 kN (8093 lbf) without failure.

27.25.5 Permanently attached manufactured system product labels shall be tested for legibility as specified in Section 28.10 and shall be legible, shall remain in place, and shall not be torn or otherwise damaged.

27.25.6 All metal hardware and hardware that includes metal parts shall be tested for corrosion resistance as specified in Section 28.8 and metals inherently resistant to corrosion including but not limited to stainless steel, brass, copper, aluminum, and zinc shall show no more than light surface–type

corrosion or oxidation. Ferrous metals shall show no corrosion of the base metal. All hardware shall remain functional as specified in the manufacturers' operating instructions.

27.25.7 Where a manufactured system contains a life safety harness subcomponent, the life safety harness shall be individually tested, labeled, and certified to meet the appropriate requirements specified in Section 27.9 in addition to the manufactured system requirements of 27.25.1 through 27.25.6 as applicable.

27.25.8 Where a manufactured system contains a belt subcomponent, the belt shall be individually tested, labeled, and certified to meet the appropriate requirements specified in Section 27.10 in addition to the manufactured system requirements of 27.25.1 through 27.25.6 as applicable.

27.25.9 All fiber and thread used in load-bearing materials and thread used in the construction of manufactured systems shall be tested for melting as specified in ASTM E794, *Standard Test Method for Melting and Crystallization Temperatures by Thermal Analysis*, and shall have a melting point of not less than 204°C (400°F).

Chapter 28 Test Methods (NFPA 1983)

28.1 Sample Preparation Procedures.

28.1.1 Application.

28.1.1.1 The sample preparation procedures contained in this section shall apply to each test method in this chapter, as specifically referenced in the sample preparation section of each test method.

28.1.1.2 Only the specific sample preparation procedure or procedures referenced in the sample preparation section of each test method shall be applied to that test method.

28.1.2 Room Temperature Conditioning Procedure.

28.1.2.1 Samples shall be conditioned at a temperature of 21°C ± 3°C (70°F ± 5°F) and a relative humidity of 65 percent ± 5 percent for at least 24 hours.

28.1.2.2 Specimens shall be tested within 5 minutes after removal from conditioning.

28.2 Rope Breaking and Elongation Test.

28.2.1 Application.

28.2.1.1 This test shall apply to life safety rope, moderate elongation laid life-saving rope, escape rope, fire escape rope, throwline, escape webbing, fire escape webbing, and manufacturer-supplied eye termination.

28.2.1.2 Modifications to this test method for testing throwline shall be as specified in 28.2.7.

28.2.1.3 Modifications to this test method for testing manufacturer-supplied eye termination shall be as specified in 28.2.8.

28.2.2 Sample.

28.2.2.1 Samples for conditioning shall be at least 1 m (1 yd) length of rope for each rope model.

28.2.2.2 Samples shall be conditioned as specified in 28.1.2.

28.2.2.3 All samples for each rope model shall be taken from the same production lot.

28.2.3 Specimens.

28.2.3.1 Specimens shall be as specified in CI 1800, *Test Methods for Life Safety Rope and Accessory Cords for Life Safety Applications.*

28.2.3.2 A minimum of five specimens shall be tested.

28.2.4* Procedure. Specimens shall be tested for elongation and minimum breaking strength in accordance with Section 7 of CI 1800, *Test Methods for Life Safety Rope and Accessory Cords for Life Safety Applications.*

28.2.4.1 Drum size for the minimum breaking strength test shall be 127 mm ± 6 mm (5 in. ± ¼ in.).

28.2.5 Report.

28.2.5.1 The rope minimum breaking strength shall be determined by subtracting three standard deviations from the mean result of five samples from the same production lot and shall be reported to the nearest 1 N (0.22 lbf).

28.2.5.2 The standard deviation shall be calculated using the formula:

[28.2.5.2]

$$s = \sqrt{\frac{n\left(\sum x^2\right) - \left(\sum x\right)^2}{n(n-1)}}$$

where:
s = standard deviation
n = number of samples
x = breaking strength

28.2.5.3 The elongation at 10 percent of the minimum breaking strength shall be reported to the nearest 0.1 percent.

28.2.5.4 The elongation at 1.35 kN (300 lbf), 2.7 kN (600 lbf), and 4.4 kN (1000 lbf) shall be reported to the nearest 0.1 percent.

28.2.6 Interpretation.

28.2.6.1 Pass/fail performance shall be based on the standard deviation from the mean breaking strength and the elongation at 10 percent of the minimum breaking strength.

28.2.6.1.1 The values obtained in 28.2.5.4 shall not be used to determine pass/fail.

28.2.6.2 One or more specimens failing this test shall constitute failing performance for the rope type.

28.2.7 Specific Requirements for Testing Throwline.

28.2.7.1 For specimens of throwline, only breaking strength testing shall be conducted.

28.2.7.2 Elongation shall not be evaluated.

28.2.8 Specific Requirements for Testing Manufacturer-Supplied Eye Termination.

28.2.8.1 For specimens of manufacturer-supplied eye terminations, only breaking strength testing shall be conducted.

28.2.8.2 Elongation shall not be evaluated.

28.2.8.3 Eye termination shall be connected to test apparatus with test pin.

28.2.8.4 Where testing is being conducted on manufacturer-supplied eye termination and the rope or webbing used in the manufacturer-supplied eye termination is certified as a life safety rope with a diameter of less than 12 mm (0.47 in.) as escape webbing, an escape rope, or a throwline, then a connector with a cross-sectional 6 mm ± 0.05 mm (0.24 in. ± 0.002 in.) radii shall be used.

28.2.8.5 Where testing is being conducted on manufacturer-supplied eye termination and the rope used in the manufacturer-supplied eye termination is certified as a life safety rope with diameter of 12 mm (0.47 in.) or greater, then a connector with a cross-sectional 8 mm ± 0.05 mm (0.32 in. ± 0.002 in.) radii shall be used.

28.3 Static Test.

28.3.1 Application.

28.3.1.1 This test shall apply to ladder belts, escape belts, Class II and Class III life safety harnesses, and Class II and Class III victim extrication devices.

28.3.1.2 Each model of a belt, a life safety harness, or a victim extrication device shall be tested in accordance with Table 28.3.1.2, as appropriate for the product.

28.3.1.3 Modifications to this test method for testing Class II harness shall be as specified in 28.3.8.

28.3.1.4 Modifications to this test method for testing Class III harness shall be as specified in 28.3.9.

28.3.1.5 Modifications to this test method for testing ladder belts shall be as specified in 28.3.10.

28.3.1.6 Modifications to this test method for testing escape belts shall be as specified in 28.3.11.

28.3.1.7 Modifications to this test method for testing positioning attachments shall be as specified in 28.3.12.

28.3.1.8 Modifications to this test method for testing Class II victim extrication devices shall be as specified in 28.3.13.

28.3.1.9 Modifications to this test method for testing Class III victim extrication devices shall be as specified in 28.3.14.

28.3.2 Samples.

28.3.2.1 Samples for conditioning shall be whole items.

28.3.2.2 Samples shall be conditioned as specified in 28.1.2.

28.3.2.3 Samples shall be new and in unused condition and shall conform in all respects to the manufacturer's specifications for the model being tested.

28.3.3 Specimens.

28.3.3.1 Specimens shall be whole items.

28.3.3.2* A minimum of three specimens shall be tested for each test.

28.3.4 Apparatus. The rigid test torso specified in Figure 1 of ASTM F1772, *Standard Specification for Climbing Harnesses,* shall be used with the following modifications, as shown in Figure 28.3.4:

(1) The legs shall be 310 mm ± 30 mm (12 in. ± 1 in.) in length.
(2) The distance between the inner thighs at the crotch shall be 50 mm ± 5 mm (2 in. ± ¼ in.).

28.3.4.1 The test torso shall weigh 136 kg ± 1 kg (300 lb ± 2¼ lb).

28.3.4.2 The test torso with the sample harness attached shall be identified as the test mass.

28.3.5 Procedure.

28.3.5.1 The specimen shall be donned on the rigid test torso as specified in the manufacturer's user instructions.

28.3.5.2 The test mass shall be attached to the test machine at the load-bearing attachment point, in accordance with the manufacturer's instruction for use, with a suitable locking carabiner.

28.3.5.3 The test mass shall be properly positioned by preloading up to 800 N (181 lbf) with the test torso in the required position.

28.3.5.4 Under the load specified in 28.3.5.3, the load-bearing attachment point(s) shall be placed approximately symmetrically about the vertical axis of the test torso as shown in Figure 28.3.5.4.

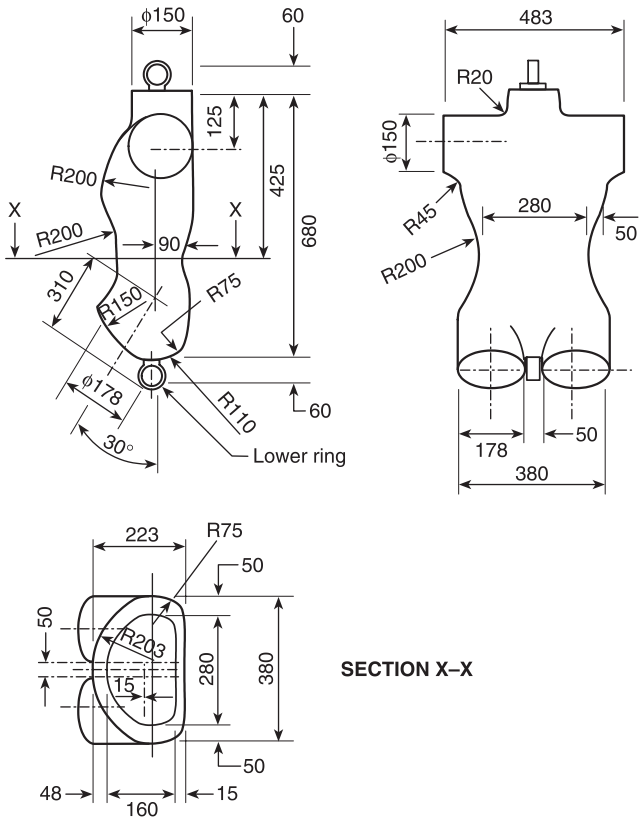
28.3.5.5 For the upright position, the test torso shall be oriented in an upright position. For the head-down position, the test torso shall be oriented in a head-down position. For the horizontal position, the test torso shall be oriented in a horizontal position supported by the neck and buttocks rings.

28.3.5.5.1 For the upright position, the force shall be applied to the buttocks ring, increasing to the specified load for the type of device over a period of 2 minutes +15/−0 seconds.

28.3.5.5.2 For the head-down position, the force shall be applied to the neck ring, increasing to the specified load for the type of device over a period of 2 minutes +15/−0 seconds.

Table 28.3.1.2 Static Test Matrix

Test	Class II	Class III	Ladder Belt	Escape Belt	Class II Extrication Device	Class III Extrication Device
Upright	YES	YES	YES	YES	YES	YES
Head down	NO	YES	NO	NO	NO	YES
Horizontal	NO	NO	YES	NO	NO	YES



Notes:
Waist circumference at X–X is 750 mm.
All linear dimensions are in millimeters, ±5 mm.
The dimensions are those of a dummy developed by the UIAA for testing harnesses.

FIGURE 28.3.4 Outline of the Test Torso.

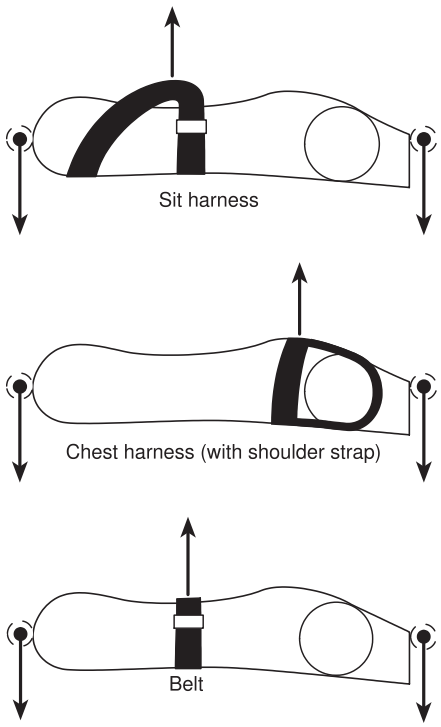


FIGURE 28.3.5.4 Test Torso Orientations for Harness Test and Belt Test.

28.3.5.5.3 For the horizontal position, the force shall be applied to the neck and buttocks rings in the plane of symmetry of the test torso and normal to its axis as shown in Figure 28.3.5.4, increasing to the specified load for the type of device over a period of 2 minutes +15/−0 seconds.

28.3.5.6 The specified load for the type of device being tested shall be held for 1 minute +15/−0 seconds and then tension shall be completely released over a maximum of 1 minute.

28.3.5.7 The specified load for the type of device being tested shall be reapplied immediately over a period of 2 minutes, +15/−0 seconds, and held for 5 minutes, +15/−0 seconds, before release.

28.3.5.8 The sample shall be evaluated at the conclusion of each static test series.

28.3.6 Report.

28.3.6.1 For each position tested, any release from the test torso shall be reported.

28.3.6.2 For each position tested, the amount of slip of any buckles and adjustment devices shall be reported.

28.3.6.3 For each position tested, any visible signs of damage that would affect the function of the harness shall be reported.

28.3.6.4 Any methods of tie-off of webbing ends shall be reported.

28.3.7 Interpretation.

28.3.7.1 Any release from the test torso shall constitute failing performance.

28.3.7.2 The amount of slip of any buckles and adjustment devices shall be used to determine pass/fail.

28.3.7.3 A harness shall be considered to be damaged to the point of failing this test if any condition that compromises the safety of the user such as but not limited to any load-bearing material being torn or damaged or where a buckle becomes nonfunctional.

28.3.8 Specific Requirements for Testing Class II Harness.

28.3.8.1 Class II harness shall be tested in the upright position, as specified in Table 28.3.1.2.

28.3.8.2* The load applied for the upright position shall be 16 kN (3597 lbf).

28.3.9 Specific Requirements for Testing Class III Harness.

28.3.9.1 Class III harness shall first be tested in the upright position, followed by the head-down position, as specified in Table 28.3.1.2.

28.3.9.2* The load applied for the upright position shall be 16 kN (3597 lbf), and the load applied for the head-down position shall be 10 kN (2248 lbf).

28.3.9.3 Where sample Class III life safety harness include shoulder attachment points, such shoulder attachment points

shall be tested only as specified in 28.3.5.5.1 for the upright position as a pair using an appropriate spreader device.

28.3.10 Specific Requirements for Testing Ladder Belts.

28.3.10.1 Ladder belts shall first be tested in the upright position, followed by the horizontal position as specified in Table 28.3.1.2.

28.3.10.2* The load applied for the upright position shall be 13 kN (2923 lbf) and the load applied for the horizontal position shall be 10 kN (2248 lbf).

28.3.11 Specific Requirements for Testing Escape Belts.

28.3.11.1 Escape belts shall first be tested in the upright position, as specified in Table 28.3.1.2.

28.3.11.2* The load applied for the upright position shall be 13 kN (2923 lbf).

28.3.12 Specific Requirements for Testing Positioning Attachments.

28.3.12.1 Where used on ladder belts, side D-rings and attachment points designated by the manufacturer for use as positioning attachments only shall be tested as positioning attachments and shall be tested as specified in 28.3.5.5.1 for the upright position and 28.3.5.5.3 for the horizontal position.

28.3.12.1.1 The load applied for the upright position shall be 13 kN (2923 lbf) and the load applied for the horizontal position shall be 10 kN (2248 lbf).

28.3.12.2 Where used on escape belts and harnesses, side D-rings and attachment points designated by the manufacturer for use as positioning attachments only shall be tested as positioning attachments and shall be tested as specified in 28.3.5.5.1 for the upright position.

28.3.12.2.1 The load applied for the upright position shall be 13 kN (2923 lbf).

28.3.12.2.2 Where life safety harnesses include side D-rings designated by the manufacturer for use as positioning attachment points only, such side D-rings shall be tested as a pair using an appropriate spreader device.

28.3.13 Specific Requirements for Testing Class II Victim Extrication Devices.

28.3.13.1 Class II victim extrication devices shall be tested in the upright position as specified in Table 28.3.1.2.

28.3.13.2* The load applied for the upright position shall be 16 kN (3597 lbf).

28.3.14 Specific Requirements for Testing Class III Victim Extrication Devices.

28.3.14.1 Class III victim extrication devices shall be tested in the upright position, followed by the head-down position, then followed by the horizontal position as specified in Table 28.3.1.2.

28.3.14.2* The load applied for the upright position shall be 16 kN (3597 lbf), and the load applied for the head-down and horizontal positions shall be 10 kN (2248 lbf).

28.4 Drop Test.

28.4.1 Application.

28.4.1.1 This test shall apply to life safety harness and escape belts.

28.4.1.2 Each model of escape belts or life safety harness shall be tested in accordance with Table 28.4.1.2 as appropriate for the type of belt and class of harness.

28.4.1.3 Modifications to this test method for testing escape belts shall be as specified in 28.4.8.

28.4.1.4 Modifications to this test method for testing life safety harness shall be as specified in 28.4.9.

28.4.2 Samples.

28.4.2.1 Samples for conditioning shall be whole items.

28.4.2.2 Samples shall be conditioned as specified in 28.1.2.

28.4.2.3 Samples shall be new and in unused condition and shall conform in all respects to the manufacturer's specifications for the model to be tested.

28.4.3 Specimens.

28.4.3.1 Specimens shall be whole items.

28.4.3.2* A total of three specimens shall be tested for each test.

28.4.4 Apparatus.

28.4.4.1 The rigid test torso specified in Figure 1 of ASTM F1772, *Standard Specification for Harnesses for Rescue and Sport Activities*, shall be used with the following modifications, as shown in Figure 28.3.4:

(1) The legs shall be 310 mm ± 30 mm (12 in. ± 1 in.) in length.
(2) The distance between the inner thighs at the crotch shall be 50 mm ± 5 mm (2 in. ± ¼ in.).

28.4.4.1.1 The test torso shall weigh 136 kg ± 1 kg (300 lb ± 2¼ lb).

28.4.4.1.2 The test torso with the sample harness attached shall be identified as the test mass.

28.4.4.2 A drop tower shall be used and shall have an anchorage point that shall not have a deflection greater than 1 mm (0.04 in.) when a force of 20 kN (4500 lbf) is applied and shall have a minimum natural frequency of 200 Hz when measured along the vertical axis of the anchorage.

28.4.4.3 A test lanyard shall be used to connect the load-bearing attachment point(s) to the test mass and shall be fabricated from Type 302 stainless steel or stainless steel of similar properties, 7 × 19 aircraft cable construction in accordance with MIL-DTL-83420N, Detail Specification: Wire Rope, Flexible, for Aircraft Control.

Table 28.4.1.2 Harness Drop Test Matrix

Test	Class II	Class III	Ladder Belt	Escape Belt
Drop	YES	YES	NO	YES

28.4.4.3.1 The test lanyard shall be 9.5 mm (⅜ in.) in diameter and 1.2 m ± 13 mm (47 in. ± ½ in.) in length measured from bearing point to bearing point between snap hooks when the lanyard is under tension of 50 N (11 lbf).

28.4.4.3.2 The lanyard shall be equipped with a snap hook at each end.

28.4.4.3.3 The lanyard shall be connected to the load-bearing attachment point(s) of the test mass.

28.4.4.3.4 The lanyard ends shall be finished with swaged eyes in such a manner as to prevent slippage of the eyes and snap hooks that would change the length of the test lanyard.

28.4.5 Procedure.

28.4.5.1 The specimen shall be donned on the rigid test torso as specified in the manufacturer's user instructions, and the test torso shall be connected to the drop tower anchorage point.

28.4.5.2 One end of the test lanyard shall be attached to a load-bearing attachment point, and the other end shall be attached to the anchorage.

28.4.5.3 The attachment point of the sample on the test mass shall be raised to and released from a point no more than 305 mm (12 in.) horizontally from the anchorage.

28.4.5.4 The attachment point of the sample on the test mass shall be in a position that will allow it to fall freely a distance of 1 m (39 in.) to a free-hanging position without interference or obstruction or striking the floor, ground, or any other object during the test.

28.4.6 Report. For each sample tested during the drop test series, the result of each drop test shall be individually reported for each attachment point.

28.4.6.1 Any methods of tie-off of webbing ends shall be reported.

28.4.7 Interpretation. A specimen shall be considered to have failed the test if, during any one of the required drops for any sample, the test mass impacts the ground.

28.4.8 Specific Requirements for Testing Escape Belts.

28.4.8.1 Each model of belt shall be tested according to Table 28.4.1.2 for the appropriate belt type.

28.4.8.2 A minimum of two drop tests shall be conducted for each specimen.

28.4.8.2.1 The first drop test shall be conducted for each load-bearing attachment point with the test mass in a head-up position.

28.4.8.2.2 The second drop test shall be conducted for each load-bearing attachment point with the test mass in a head-down position.

28.4.8.2.3 A minimum of 5 minutes shall pass between consecutive drops.

28.4.9 Specific Requirements for Testing Life Safety Harness.

28.4.9.1 Each model of harness shall be tested according to Table 28.4.1.2 for the appropriate class harness.

28.4.9.2 A minimum of two drop tests shall be conducted for each specimen.

28.4.9.2.1 The first drop test shall be conducted for each load-bearing attachment point with the test mass in a head-up position.

28.4.9.2.2 The second drop test shall be conducted for each load-bearing attachment point with the test mass in a head-down position.

28.4.9.2.3 A minimum of 5 minutes shall pass between consecutive drops.

28.5 Carabiner and Snap-Link Tensile Test.

28.5.1 Application. This test method shall apply to all carabiners and snap links.

28.5.2 Samples.

28.5.2.1 Samples for conditioning shall be whole items.

28.5.2.2 Samples shall be conditioned as specified in 28.1.2.

28.5.2.3 Samples shall be new and in unused condition and shall conform in all respects to the manufacturer's specification for the model being tested.

28.5.2.4 Samples shall be taken from the same production lot for each model tested.

28.5.3 Specimens.

28.5.3.1 Specimens shall be whole items.

28.5.3.2 A total of five specimens shall be tested for each performance requirement.

28.5.3.3 A separate specimen shall be used for each test.

28.5.4 Procedure. Test methods shall be conducted per ASTM F1956, *Standard Specification for Rescue Carabiners.*

28.5.5 Report.

28.5.5.1 The breaking strength of each specimen shall be reported to the 0.1 kN (23 lb) of force.

28.5.5.2 An average breaking strength shall be calculated for each position tested.

28.5.5.3 The carabiner minimum breaking strength shall be determined by subtracting three standard deviations from the mean results of five samples from the same production lot and shall be reported to the nearest 0.1 kN (23 lbf). The minimum breaking strength shall be provided on the product label as specified in 25.15.1.

28.5.5.4 The standard deviation shall be calculated using the formula in 28.2.5.2.

28.5.6 Interpretation.

28.5.6.1* Pass/fail performance shall be based on the minimum breaking strength for each of the positions tested.

28.5.6.2 Failure in any position constitutes failure for the carabiner or snap link.

28.6 Manner of Function Tensile Test.

28.6.1 Application.

28.6.1.1 This test shall apply to ascending devices, rope grab devices, descent control devices, and belay devices.

28.6.1.2 Modifications to this test method for testing ascending devices and rope grab devices shall be as specified in 28.6.7.

28.6.1.3 Modifications to this test method for testing descent control devices shall be as specified in 28.6.8.

28.6.1.4 Modifications to this test method for testing belay devices shall be as specified in 28.6.9.

28.6.2 Samples.

28.6.2.1 Samples for conditioning shall be whole items.

28.6.2.2 Samples shall be conditioned as specified in 28.1.2.

28.6.2.3 Samples shall be new and in unused condition and shall conform in all respects to the manufacturer's specifications for the model to be tested.

28.6.3 Specimens.

28.6.3.1 Specimens shall be whole items.

28.6.3.2 A total of three specimens shall be tested.

28.6.3.3 Each specimen shall be tested to Procedure A.

28.6.4 Procedure.

28.6.4.1 Testing shall be conducted in the "manner of function" for the item being tested.

28.6.4.2 Testing shall be conducted using both the smallest and largest diameter life safety rope specified by the device manufacturer for testing.

28.6.4.2.1 Testing shall be conducted using a rope with the same NFPA designation as the device being tested, unless such rope is outside of the range of ropes that the manufacturer specifies for the safe and critical function of the device.

28.6.4.2.2 The rope used for testing shall meet the static rope requirements of CI 1801, *Performance Requirements for Low Stretch and Static Life Safety Rope.*

28.6.4.2.3 The device shall be attached to the rope according to the manufacturer's instructions.

28.6.4.3 Procedure A.

28.6.4.3.1 One end of the rope shall be anchored on to a tensile testing machine and the device shall be anchored to the other end of the rope. The specified deformation force shall be applied to the device at the normal attachment point at a rate of 25 mm/min ± 5 mm/min (1 in./min ± ¼ in./min).

28.6.4.3.2 The specified deformation force shall be held for 30 seconds +1/−0 second, and then the tension shall be completely released over a maximum of 1 minute.

28.6.4.3.3 In the case of items that are designed to slip under high load, the rope shall be knotted or the device otherwise blocked to prevent slippage.

28.6.4.3.4 The device shall then be inspected for damage to the device or to the rope used for testing.

28.6.4.4 Procedure C.

28.6.4.4.1 The belay device shall be tested for function according to ASTM F2436, *Standard Test Method for Measuring the Performance of Synthetic Rope Rescue Belay Systems Using a Drop Test,* as modified for this standard.

28.6.4.4.2 A rope that is 300 cm ± 0.5 cm (118.11 in. ± 0.2 in.) shall be used between the bowline test–block contact and the most distal point of the gripping portion of the belay assembly.

28.6.4.4.3 The attachment point of the sample on the test mass shall be raised to and released from a point no more than 305 mm (12 in.) horizontally from the anchorage.

28.6.4.4.4 A drop height of 100 cm ± 0.5 cm (39.37 in. ± 0.2 in.) shall be used.

28.6.4.4.5 The test mass for a technical-use belay device shall be 136 kg (300 lb).

28.6.4.4.6 The test mass for a general-use belay device shall be 272 kg (600 lb).

28.6.4.4.7 The parameters specified in 28.6.4.4.7.1, 28.6.4.4.7.2, and 28.6.4.4.7.3 shall be evaluated to determine pass/fail.

28.6.4.4.7.1 Maximum extension of the belay system shall be no more than 1 m ± 5 cm (3.28 ft ± 1.97 in.).

28.6.4.4.7.2 Impact force shall be no more than 15 kN (3372 lbf).

28.6.4.4.7.3* The device shall be able to release the load in a controlled manner.

28.6.5 Report.

28.6.5.1 The condition of the item and the rope shall be recorded after the deformation load has been applied.

28.6.5.2 For Procedure C, the device shall be reported as technical use or general use.

28.6.5.2.1 The extension of the belay system shall be recorded.

28.6.5.2.2 Any damage to the rope, the belay device, or system components shall be recorded.

28.6.5.2.3 Maximum impact force shall be recorded.

28.6.6 Interpretation. One or more specimens failing this test shall constitute failing performance for the item being tested.

28.6.6.1 Failure of the rope at a load less than the specified rope minimum breaking strength shall constitute failing performance.

28.6.7 Specific Requirements for Testing Ascent Devices and Rope Grab Devices.

28.6.7.1* Technical-use ascent devices and rope grab devices shall be tested at a load of 5 kN (1124 lbf) for Procedure A.

28.6.7.2 General-use ascent devices and rope grab devices shall be tested at a load of 11 kN (2500 lbf) for Procedure A.

28.6.8 Specific Requirements for Testing Descent Control Devices.

28.6.8.1 Escape and technical-use descent control devices shall be tested at a load of 5 kN (1124 lbf) for Procedure A.

28.6.8.2 The device shall be attached to the rope according to the manufacturer's instructions in the locked-off mode of attachment.

28.6.8.3 General-use descent control devices shall be tested at a load of 11 kN (2500 lbf) for Procedure A.

28.6.9 Specific Requirements for Belay Devices. Belay devices shall only be tested for Procedure C.

28.7 Breaking Strength Test.

28.7.1 Application.

28.7.1.1 This test shall apply to portable anchor devices, escape systems, fire escape systems, manufactured systems, end-to-end straps, multiple configuration straps, escape anchors, pulleys, and other auxiliary equipment.

28.7.1.2 Specific requirements for testing portable anchors shall be as specified in 28.7.8.

28.7.1.3 Specific requirements for testing pulleys shall be as specified in 28.7.9.

28.7.1.4 Specific requirements for testing fire escape systems, escape systems, and manufactured systems shall be as specified in 28.7.10.

28.7.1.5 Specific requirements for testing end-to-end straps shall be as specified in 28.7.11.

28.7.1.6 Specific requirements for testing escape anchor devices shall be as specified in 28.7.13.

28.7.1.7 Specific requirements for testing multiple-configuration shall be as specified in 28.7.12.

28.7.1.8 Specific requirements for manufactured systems shall be as specified in 28.7.14.

28.7.2 Samples.

28.7.2.1 Samples for conditioning shall be whole items or systems.

28.7.2.2 Samples shall be conditioned as specified in 28.1.2.

28.7.2.3 Samples shall be new and in unused condition and shall conform in all respects to the manufacturer's specifications for the model being tested.

28.7.3 Specimens.

28.7.3.1 Specimens shall be whole items or systems.

28.7.3.2 A total of five specimens shall be tested.

28.7.4 Procedure A.

28.7.4.1* The device shall be positioned as required for the type of device being tested in the lowest strength configuration of the device as specified by the manufacturer.

28.7.4.2 A force shall be applied to the device, increasing to the load specified at a rate of 25 mm/min ± 5 mm/min (1 in./min ± ¼ in./min).

28.7.4.3 The force shall be held for 30 seconds, ± 1.0 second, and then the tension shall be completely released over a maximum of 1 minute.

28.7.4.4 The force shall be reapplied immediately and shall be increased to the same maximum force as previously exerted at a rate of 25 mm/min ± 5 mm/min (1 in./min ± ¼ in./min) and held for 1 minute, +15/−0 seconds, before release.

28.7.4.5 At the conclusion of Procedure A, the specimen device shall be inspected for deformation.

28.7.5 Procedure B.

28.7.5.1* Using a new specimen and the test set up as in Procedure A, the load shall be reapplied to the lowest strength configuration of the device as specified by the manufacturer until the breaking point of the device.

28.7.5.2 The force shall be applied at a rate of 25 mm/min ± 5 mm/min (1 in./min ± ¼ in./min).

28.7.6 Report.

28.7.6.1 The minimum breaking strength shall be determined by subtracting three standard deviations from the mean results of five samples from the same production lot and shall be reported to the nearest 0.1 kN (23 lbf). The minimum breaking strength shall be provided on the product label as specified in Chapter 25.

28.7.6.2 The standard deviation shall be calculated using the formula in 28.2.5.2.

28.7.6.3 The deflection of the load-bearing members from their original position shall be recorded.

28.7.6.4 The functionality of adjustment and moving parts shall be recorded.

28.7.6.5 Where applicable, the movement of all base contact points from their original positions shall be recorded.

28.7.6.6 Any condition that would cause the safety of the user to be compromised shall be recorded.

28.7.6.7 Any fracture of the load-bearing members, collapse, or other condition that would cause the user to be dropped shall be reported.

28.7.6.8* The configuration of the attachment of the device to the testing machine shall be recorded and reported.

28.7.7 Interpretation. One or more specimens failing this test shall constitute failing performance for the item being tested.

28.7.8 Specific Requirements for Testing Portable Anchors.

28.7.8.1 Two specimens shall be tested.

28.7.8.2 Where there are multiple load-bearing attachment points, Procedure A and Procedure B shall be repeated for each combination of load-bearing attachment points specified in the manufacturer's instructions.

28.7.8.3 The device shall be attached to the test machine at the load-bearing attachment point, in accordance with the manufacturer's instructions for use, with a suitable locking carabiner.

28.7.8.4 Before testing, the device shall be positioned with all surface contact points securely seated on a flat, unfinished concrete surface in the manner described by the manufacturer's instructions.

28.7.8.5* Where portable anchor devices are designed to be affixed to a base that is not part of the device, the manufacturer shall provide a test base that most closely resembles the structural element to which the device is designed to be affixed.

28.7.8.5.1 The test base shall be completely stable and shall be permitted to be bolted down to prevent movement during the test.

28.7.8.6 The portable anchor device shall be accompanied by all adjuncts required for use as described by the manufacturer's instructions for use.

28.7.8.6.1 Devices shall not be bolted to, tied off, or affixed to the test base in any way unless required to be by the manufacturer for normal use.

28.7.8.6.2 All adjuncts designed by the manufacturer to be used in conjunction with the device, including but not limited to ropes, chains, webbing, rope grabs, and bolts, shall be in place during the test.

28.7.8.7 For Procedure B, each point of contact with the test surface shall be marked in some manner to allow the ability to assess movement of the base during the test.

28.7.8.7.1 For Procedure B, the force specified in 27.19.3 for technical use and 27.19.4 for general use shall be applied and held for 2 minutes, +15/−0 seconds, without failure.

28.7.8.8 The test load used for Procedure A shall be 5 kN (1124 lbf) for technical-use portable anchors and 13 kN (2923 lbf) for general-use portable anchors.

28.7.8.9 For the report, breaking strength shall be the strength specified in 27.19.3 for technical use and 27.19.4 for general use.

28.7.9 Specific Requirements for Testing Pulleys.

28.7.9.1 Pulleys shall be tested using a wire rope with a diameter equal to or less than the maximum size of rope specified for the pulley and of sufficient strength. The wire rope shall include a swaged loop that fits the pulley being tested.

28.7.9.1.1 If pulleys cannot be opened or disassembled, life safety rope with a diameter equal to or less than the maximum size of rope specified for the pulley and of sufficient strength shall be acceptable for testing.

28.7.9.2 Tension shall be applied between the wire rope loop and a 12.5 mm ± 1 mm (½ in. ± ⅛ in.) pin through the pulley carabiner hole as specified in Figure 28.7.9.2 until failure.

28.7.9.3 Fixture design and device placement in fixture shall not allow the fixture to interfere with the pulley during the test.

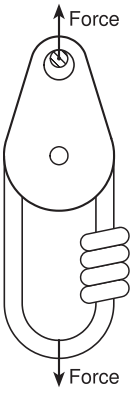


FIGURE 28.7.9.2 Pulley Tensile Test.

28.7.9.4 Pulleys with two or more sheaves shall have a single rope looped around all sheaves and the load applied to each loop.

28.7.9.5 Pulleys that include a becket at the bottom of the pulley shall have the becket tested by applying a load longitudinally between the carabiner hole and the becket.

28.7.9.6 The test load used for Procedure A shall be 8 kN (1798 lbf) for technical-use pulleys and 22 kN (4946 lbf) for general-use pulleys.

28.7.10 Specific Requirements for Escape Systems and Fire Escape Systems.

28.7.10.1 Only Procedure B shall be conducted on fire escape systems and escape systems.

28.7.10.2 Where there are multiple load-bearing attachment points, Procedure B shall be repeated for each combination of load-bearing attachment points specified in the manufacturer's instructions.

28.7.10.3 The device shall be attached to the test machine at the load-bearing connecting point, in accordance with the manufacturer's instructions for use.

28.7.10.4 For all tests, the device shall be accompanied by all equipment required for use as described by the manufacturer's instructions for use.

28.7.10.5 Only the requirements specified in 28.7.6.1 shall be reported.

28.7.11 Specific Requirements for Testing End-to-End Straps.

28.7.11.1 Only Procedure B shall be conducted on end-to-end straps.

28.7.11.2* Testing shall be conducted using 13 mm ± 1 mm (½ in. ± ⅛ in.) pins, bolts, or shackles.

28.7.11.3 A test pin cross section shall be permitted to be other than round. Any cross section necessary to prevent test pin failure or any design to prevent test pin rotation shall be permitted, as long as the contact point between the test pin and strap attachment point has the specified radius, material type, hardness, and surface roughness as per Section 6.2.1 of ASTM F1956, *Standard Specification for Rescue Carabiners*.

28.7.11.4 The test fixture shall be designed to prevent the test pins from rotating such that the strap is free to locate itself on the test pins when force is applied.

28.7.11.5 Where the strap is adjustable in length, the strap shall be tested in the shortest length that places the adjustment device free of any interference of the test fixture.

28.7.11.6 Technical-use and general-use end-to-end straps shall be individually tested in the end-to-end configuration.

28.7.11.7 Where the strap is adjustable in length, the slippage of the adjustment device shall be measured and reported upon completion of the test.

28.7.12 Specific Requirements for Testing Multiple-Configuration Straps.

28.7.12.1 Only Procedure B shall be conducted on multiple-configuration straps.

28.7.12.2* Testing shall be conducted using 13 mm ± 1 mm (½ in. ± ⅛ in.) pins, bolts, or shackles.

28.7.12.3 Test pin cross section shall be permitted to be other than round, and any cross section necessary to prevent test pin failure or any design to prevent test pin rotation shall be permitted as long as the contact point between the test pin and strap attachment point has the specified radius, material type, hardness, and surface roughness as per Section 6.2.1 of ASTM F1956, *Standard Specification for Rescue Carabiners.*

28.7.12.4 The test fixture shall be designed to prevent the test pins from rotating such that the strap is free to locate itself on the test pins when force is applied.

28.7.12.5 Where the strap is adjustable in length, the strap shall be tested in the shortest length that places the adjustment device free of any interference of the test fixture.

28.7.12.6 Technical-use and general-use multiple-configuration straps shall be individually tested in the basket (U) configuration, the end-to-end configuration, and the choker configuration.

28.7.12.7 For technical-use and general-use multiple-configuration straps, all configuration values shall be reported on the product label, and only the basket (U) configuration value shall be utilized to determine pass/fail.

28.7.13 Specific Requirements for Escape Anchor Devices.

28.7.13.1 Only Procedure B shall be conducted on escape anchor devices.

28.7.13.2 Escape anchor devices with a single point of contact shall be loaded in such a way that the load is applied in the weakest configuration where used in accordance with the manufacturer's instructions. The support shall not prevent the device from deforming under load or from releasing from the structure due to deformation or breaking.

28.7.13.3 Escape anchor devices that use two or more points of contact shall have the load applied in the weakest configuration where used in accordance with the manufacturer's instructions.

28.7.13.4 The escape anchor device shall fail the Procedure B test if the device breaks or deforms such that it releases from the supporting structure.

28.7.13.5 Only the requirements specified in 28.7.6.1 shall be reported.

28.7.14 Specific Requirements for Manufactured Systems.

28.7.14.1 Where there are multiple load-bearing attachment points, Procedure B shall be repeated for each combination of load-bearing attachment points specified in the manufacturer's instructions.

28.7.14.2 The device shall be attached to the test machine at the load-bearing connecting point, in accordance with the manufacturer's instructions for use.

28.7.14.3 For all tests, the device shall be accompanied by all equipment required for use as described by the manufacturer's instructions for use.

28.7.14.4 Only the requirements specified in 28.7.6.1 shall be reported.

28.7.14.5 The test load used for Procedure A shall be 5 kN (1124 lbf) for technical-use manufactured systems and 13 kN (2923 lbf) for general-use manufactured systems.

28.8 Corrosion Resistance Test.

28.8.1 Application. This test shall apply to all metal hardware and hardware that includes metal parts.

28.8.2 Samples.

28.8.2.1 Samples for conditioning shall be metal hardware or hardware that includes metal parts.

28.8.2.2 Samples shall be conditioned as specified in 28.1.2.

28.8.3 Specimens.

28.8.3.1 Specimens shall be metal hardware or hardware that includes metal parts.

28.8.3.2 Five specimens of each hardware type shall be tested.

28.8.4 Procedure.

28.8.4.1 Specimens shall be tested in accordance with ASTM B117, *Standard Practice for Operating Salt Spray (Fog) Apparatus.* Salt spray shall be 5 percent saline solution, and test exposure shall be for 50 hours.

28.8.4.2 Immediately following the test exposure and prior to examination, specimens shall be rinsed under warm, running tap water and dried with compressed air.

28.8.4.3 Specimens shall then be examined visually by the unaided eye to determine pass/fail.

28.8.4.4 The functionality of each specimen shall be evaluated.

28.8.5 Report. The presence of corrosion and the functionality of each specimen shall be reported.

28.8.6 Interpretation. One or more hardware specimens failing this test shall constitute failing performance for the hardware type.

28.9 Floatability Test.

28.9.1 Application. This test shall apply to throwline.

28.9.2 Samples.

28.9.2.1 Samples for conditioning shall be at least 1 m (1 yd) in length.

28.9.2.2 Samples shall be conditioned as specified in 28.1.2.

28.9.3 Specimens.

28.9.3.1 Specimens shall be 1 m (1 yd) in length.

28.9.3.2 A minimum of three specimens shall be tested.

28.9.3.3 The ends of the specimen shall be heat-sealed.

28.9.4 Procedure.

28.9.4.1 Specimens shall be completely submerged to a minimum depth of 380 mm (15 in.) in a sufficiently sized vessel of fresh water at a temperature of 21°C ± 3°C (70°F ± 5°F) for a period of 24 hours, +1/−0 hour.

28.9.4.2 The throwline shall then be allowed, over a maximum of 1 minute, to float to the surface.

28.9.5 Report. Observation of each specimen's ability to float within 1 minute shall be reported.

28.9.6 Interpretation. The entire length of the throwline shall float to constitute passing performance.

28.10 Product Label Durability Test.

28.10.1 Application.

28.10.1.1 This test method shall apply to permanently attached product labels and identification tapes, excluding metal stamped or engraved labels.

28.10.1.2 Specific requirements for testing rope, webbing, and throwline identification tapes shall be specified in 28.10.7.

28.10.1.3 Specific requirements for testing all other labels shall be specified in 28.10.8.

28.10.2 Samples.

28.10.2.1 Samples for conditioning shall be individual labels or, in the case of rope, webbing, or throwline, at least 1 m (1 yd) in length.

28.10.2.2 Samples shall be conditioned as specified in 28.1.2.

28.10.3 Specimens.

28.10.3.1 Specimens shall be individual labels or, in the case of rope, webbing, or throwline, 1 m (1 yd) in length.

28.10.3.2 A minimum of four of each type of label shall be tested.

28.10.3.3 Where labels have "write-in" information, two additional specimens shall be tested that include those areas with sample information written in.

28.10.4 Procedures.

28.10.4.1 Abrasion Durability Test.

28.10.4.1.1 Product label specimens shall be subjected to abrasion in accordance with ASTM D4966, *Standard Test Method for Abrasion Resistance of Textile Fabrics (Martindale Abrasion Tester Method)*, with the following modifications:

(1) The standard abrasive fabric and the felt-backing fabric shall be soaked for 24 hours or agitated in distilled water so that they are thoroughly wet.
(2) The standard abrasive fabric shall be rewetted after each set of cycles by applying 20 ml (0.68 oz) of distilled water from a squeeze bottle by squirting on the center of the abrasive pad.
(3) At least two specimens shall be subjected to 10 dry cycles, 160 revolutions, of the test apparatus.
(4) At least two specimens shall be subjected to 5 wet cycles, 80 revolutions, of the test apparatus.
(5) At least one dry and one wet test specimen shall be edge specimens.
(6) Where labels include "write-in" information at least one sample shall be tested in the dry condition and one specimen shall be tested in the wet condition.

28.10.4.1.2 Specimens shall be examined for legibility to the unaided eye by a person with 20/20 vision or vision corrected to 20/20 at a nominal distance of 305 mm (12 in.) in a well-illuminated area.

28.10.4.2 Laundering Durability Test.

28.10.4.2.1 Specimens shall be subjected to five cycles of laundering using Machine Cycle 1 and Wash Temperature V of AATCC 135, *Dimensional Changes of Fabrics after Laundering*.

28.10.4.2.2 A 1.8 kg ± 0.1 kg (4.0 lb ± ¼ lb) load shall be used. A laundry bag shall not be used.

28.10.4.2.3 Specimens shall be examined for legibility to the unaided eye by a person with 20/20 vision or vision corrected to 20/20 at a nominal distance of 305 mm (12 in.) in a well-illuminated area.

28.10.4.2.4 Specimens shall be examined to determine if the label remained in place.

28.10.5 Report.

28.10.5.1 The legibility for each specimen shall be recorded and reported as acceptable or unacceptable.

28.10.5.2 For rope, webbing, and throwline, the ability of the label to remain in place shall be reported.

28.10.6 Interpretation. One or more label specimens failing this test shall constitute failing performance.

28.10.7 Specific Requirements for Testing Rope, Webbing, and Throwline Labels. All rope, webbing, and throwline inserted identification tapes shall be tested only for laundering durability as specified in 28.10.4.2.

28.10.8 Specific Requirements for Testing All Other Labels. All harness and belt product labels shall be tested only for abrasion durability as specified in 28.10.4.1.

28.11 Holding Test.

28.11.1 Application. This test shall apply to descent control devices.

28.11.2 Samples.

28.11.2.1 Samples for conditioning shall be whole items.

28.11.2.2 Samples shall be conditioned as specified in 28.1.2.

28.11.2.3 Samples shall be new and in unused condition and shall conform in all respects to the manufacturer's specifications for the model being tested.

28.11.3 Specimens.

28.11.3.1 Specimens shall be whole items.

28.11.3.2 Three specimens shall be tested.

28.11.4 Procedure.

28.11.4.1 Testing shall be conducted using both the smallest and largest diameter life safety rope specified by the descent control device manufacturer for testing.

28.11.4.2 The rope used for testing shall meet the static rope requirements of CI 1801, *Performance Requirements for Low Stretch and Static Life Safety Rope*.

28.11.4.3 The descent control device shall be attached to the rope according to the manufacturer's instructions.

28.11.4.4 One end of the rope shall be anchored onto a tensile testing machine, and the descent control device with passive brake deployed shall be anchored to the other end of

the rope. A force shall be applied to the device at the normal attachment point at a rate of 25 mm/min ± 5 mm/min (1 in./min ± ¼ in./min).

28.11.4.4.1 The force for escape and technical-use descent control devices shall be 1.35 kN (300 lbf) and for general-use descent control devices shall be 2.7 kN (600 lbf).

28.11.4.5 The specified deformation force shall be held for 30 seconds, +1/−0 second, and then the tension shall be completely released over a maximum of 1 minute.

28.11.4.5.1 Any slippage of the descent control device on the rope shall then be measured.

28.11.5 Report. The slip of the descent device at the specified load shall be reported.

28.11.6 Interpretation. One or more specimens failing this test shall constitute failing performance for the item being tested.

28.12 Litter Strength Test.

28.12.1 Application. This test shall apply to litters.

28.12.2 Samples.

28.12.2.1 Samples for conditioning shall be whole items.

28.12.2.2 Samples shall be conditioned as specified in 28.1.2.

28.12.2.3 Samples shall be new and in unused condition and shall conform in all respects to the manufacturer's specifications for the model being tested.

28.12.3 Specimens.

28.12.3.1 Specimens shall be whole items.

28.12.3.2 A minimum of two specimens shall be tested in the horizontal position.

28.12.3.3 A minimum of two specimens shall be tested in the vertical position.

28.12.4 Apparatus. The apparatus shall be as specified in ASTM F2821, *Standard Test Methods for Basket Type Rescue Litters*.

28.12.5 Procedure. Litters shall be tested as specified in ASTM F2821, *Standard Test Methods for Basket Type Rescue Litters*, with the modification that both the horizontal litter test and the vertical litter test shall be performed on separate specimens.

28.12.6 Report.

28.12.6.1 The breaking strength of each specimen shall be reported to the nearest 0.1 kN (23 lbf) force.

28.12.6.2 Permanent deformation of the structural element shall be reported to the nearest 0.5 cm (0.2 in.).

28.12.6.2.1 Litters constructed of textile materials shall not be measured for deformation.

28.12.6.3 The lowest observed breaking strength shall be reported as the labeled breaking strength for each vertical and horizontal configuration.

28.12.7 Interpretation.

28.12.7.1 Failure of the device prior to the application of the 11 kN (2473 lbf) test load shall constitute failure of the litter.

28.12.7.2 Permanent deformation of any structural element of more than 5 cm ± 0.5 cm (2 in. ± 0.2 in.) during testing shall constitute failure of the litter.

28.13 Payout Test.

28.13.1 Application.

28.13.1.1 This test shall apply to escape systems and fire escape systems.

28.13.2 Samples.

28.13.2.1 Samples shall be new and in unused condition and shall conform in all respects to the manufacturer's specifications for the model to be tested.

28.13.2.2 The rope length available for testing shall be at least 1.5 m (5 ft).

28.13.2.3 If multiple configurations are possible with the descent control device, it shall be tested in each configuration.

28.13.2.4 Samples for conditioning shall be whole items.

28.13.2.5 Samples shall be conditioned as specified in 28.1.2.

28.13.3 Specimens.

28.13.3.1 Specimens shall be whole items.

28.13.3.2 A total of three specimens shall be tested and each test repeated 5 times.

28.13.4 Procedure.

28.13.4.1 Specimens shall be tested in a servohydraulic or screw-driven load frame with a controlled displacement rate of 100 mm/sec (±5 mm/sec).

28.13.4.2 For descent control devices with the capability to vary friction with the rope, the device shall be locked open in the configuration the manufacturer recommends for actual use. The manner of locking the device shall not affect the load measurement during payout.

28.13.4.3 The rope shall be attached to a solid anchorage point and the descent control device attached to the moving crosshead of the load frame. The rope shall enter the descent device directly without creating additional friction throughout the test.

28.13.4.4 Each test shall require the rope to pass through the descent control device for 100 mm (4 in.).

28.13.4.5 Load data shall be recorded at a minimum sampling rate of 1000 samples/sec.

28.13.5 Report. The average force encountered over the 100 mm (4 in.) payout shall be recorded from each test and the average calculated.

28.13.6 Interpretation.

28.13.6.1 Pass/fail performance shall be based on the average force required to payout rope through the descent control device.

28.13.6.2 One or more specimens failing this test shall constitute a failing performance for the given rope type.

28.13.6.3 If multiple configurations are possible with the descent control device, the pass/fail criteria shall be applied for each configuration.

28.13.6.4 The compliant configuration shall be listed in the user instructions.

28.14 Escape Descent Control Device and Systems Drop Test.

28.14.1 Application. This test shall apply to escape descent control devices, escape systems, and fire escape systems.

28.14.2 Samples.

28.14.2.1 Samples for conditioning shall be whole items.

28.14.2.2 Samples shall be conditioned as specified in 28.1.2.

28.14.2.3 Samples shall be new and in unused condition and shall conform in all respects to the manufacturer's specifications for the model to be tested.

28.14.3 Specimens.

28.14.3.1 A minimum of two specimens shall be tested.

28.14.3.2 One drop shall be conducted for each specimen.

28.14.4 Procedure.

28.14.4.1 Testing shall be conducted per Section 5.6 of ISO 22159, *Personal equipment for protection against falls — Descending devices*, with the modifications specified in 28.14.4.1.1 through 28.14.4.1.4.

28.14.4.1.1 A force measurement device as described in Section 5.1.2 of ISO 22159, *Personal equipment for protection against falls — Descending devices*, shall be installed between the test mass and the descent control device.

28.14.4.1.2 The entire test mass, consisting of the falling mass itself, the attachment device(s), and force-measuring device shall weigh 136 kg ± 1kg (300 lb ± 2.25 lb).

28.14.4.1.3 On the descent control device, the length of rope or webbing between the lowest point of the top anchor and the top entry point of the rope shall be 610 mm –0/+25 mm (24 in. –0/+1 in.).

28.14.4.1.4 The test mass shall be positioned to allow for a free fall of 153 mm –0/+13 mm (6 in. –0/+½ in.)

28.14.4.2 Following each drop, the device and the rope or webbing shall be visually examined for damage and functionality while the weight is still attached. Functionality shall be determined by the lowering of the test weight in a controlled manner.

28.14.5 Report.

28.14.5.1 The maximum impact force shall be reported to the nearest 0.1 kN (23 lbf).

28.14.5.2 Any visible damage to the device, rope or webbing shall be reported.

28.14.5.3 Functionality of the device shall be reported.

28.14.6 Interpretation.

28.14.6.1 A recorded impact force in excess of 8.0 kN (1798 lbf) shall constitute failing performance.

28.14.6.2 Visible damage to device, rope, or webbing shall constitute failing performance.

28.14.6.3 Failure of the device to function shall constitute failing performance.

28.14.6.4 One or more specimens failing the test shall constitute failing performance.

28.15 Elevated Temperature Rope Test.

28.15.1 Application.

28.15.1.1 This test shall apply to fire escape rope, fire escape webbing, and any lifeline used in a fire escape system. This test shall also apply to manufacturer-supplied eye terminations for fire escape rope, fire escape webbing, and any lifeline used in a fire escape system.

28.15.2 Samples.

28.15.2.1 Samples for conditioning shall be whole items.

28.15.2.2 Samples shall be conditioned as specified in 28.1.2.

28.15.2.3 Samples shall be new and in unused condition and shall conform in all respects to the manufacturer's specifications for the model to be tested.

28.15.2.4 Where ropes utilize different combination of fiber materials, including, but not limited to, tracers, each combination shall be tested.

28.15.3 Specimens.

28.15.3.1 Specimens shall be whole items.

28.15.3.2 A total of three specimens shall be tested.

28.15.4 Procedure.

28.15.4.1* Rope specimens shall be tested in a manner that allows a constant load to be applied to the rope throughout the duration of the test after stabilization. One end of the rope shall be attached to a load or load cell, while the other shall be attached to an apparatus that allows constant load application.

28.15.4.1.1* Manufacturer-supplied eye terminations shall be tested in a manner that allows a constant load to be applied to the eye throughout the duration of the test after stabilization. A length of rope or webbing meeting the fire escape rope or fire escape webbing requirements of this standard shall be looped through the eye and shall be attached to a load or load cell, while the rope end of the manufacturer-supplied eye termination shall be attached to an apparatus that allows constant load application.

28.15.4.2 Specimens shall be introduced into a horizontal, three-zone, high-temperature furnace at the given set point –0/+10°C (–0/50°F) and the load stabilized within 5 seconds of introduction.

28.15.4.2.1* Temperature shall be verified before each series of tests.

28.15.4.3 A thermocouple shall be attached to the rope, webbing, or eye at the location of the maximum temperature of the furnace. The exposure time shall begin when the specimen is under load and the thermocouple reading increases by 10 percent from room temperature. The exposure time ends when the rope can no longer support the load.

28.15.5 Report. The time to failure shall be recorded for each test.

28.15.6 Interpretation. One or more specimens failing this test shall constitute failing performance.

28.16 Flame Resistance Test.

28.16.1 Application.

28.16.1.1 This test method shall apply to flame-resistant life safety harness and belt webbing and materials.

28.16.1.2 Modifications to this test method for testing webbing shall be as specified in 28.16.8.

28.16.2 Samples. Samples shall consist of a 75 mm × 300 mm (3 in. × 12 in.) rectangle with the long dimension parallel to either the warp or filling, the wale or course, or the machine or cross-machine direction of the material.

28.16.3 Specimens. All specimens to be tested shall be conditioned as specified in 28.1.2.

28.16.4 Apparatus. The test apparatus specified in ASTM D6413/D6413M, *Standard Test Method for Flame Resistance of Textiles (Vertical Test)*, shall be used.

28.16.5 Procedure.

28.16.5.1 Flame-resistance testing shall be performed in accordance with ASTM D6413/D6413M, *Standard Test Method for Flame Resistance of Textiles (Vertical Test)*.

28.16.5.2 Each specimen shall be examined for evidence of melting or dripping.

28.16.6 Report.

28.16.6.1 Afterflame time and char length shall be recorded and reported for each specimen. The average afterflame time and char length for each material tested shall be calculated, reported, and recorded. The afterflame time shall be recorded and reported to the nearest 0.2 second and the char length to the nearest 3 mm (⅛ in.).

28.16.6.2 Observations of melting or dripping for each specimen shall be recorded and reported.

28.16.7 Interpretation. Pass or fail performance shall be based on any observed melting or dripping, the average afterflame time, and the average char length.

28.16.8 Specific Requirements for Testing Webbing Used in Flame-Resistant Life Safety Harnesses and Belts.

28.16.8.1 Five specimens of the webbing material shall be tested.

28.16.8.2 Webbing shall be at least 305 mm (12 in.) in length by the widest width of the webbing.

28.16.8.3 Testing shall be performed in only one direction.

28.16.8.4 Testing shall be performed as specified in 28.16.2 through 28.16.7.

28.17 Heat Resistance Test.

28.17.1 Application.

28.17.1.1 This test method shall apply to flame-resistant life safety harness and belt webbing, materials, labels, and hardware.

28.17.1.2 Modifications to this test method for testing webbing shall be as specified in 28.17.8.

28.17.1.3 Modifications to this test method for testing labels shall be as specified in 28.17.9.

28.17.1.4 Modifications to this test method for testing hardware shall be as specified in 28.17.10.

28.17.1.5 Modifications to this test method for testing other materials not covered in 28.17.1.2, 28.17.1.3, or 28.17.1.4 shall be as specified in 28.17.11.

28.17.2 Samples. All samples shall be conditioned as specified in 28.1.2.

28.17.3 Specimens.

28.17.3.1 Heat resistance testing shall be conducted on a minimum of three specimens for each item.

28.17.4 Apparatus. The test oven shall be as specified in ASTM F2894, *Standard Test Method for Evaluation of Materials, Protective Clothing and Equipment for Heat Resistance Using a Hot Air Circulating Oven*, and testing shall be carried out at a temperature of 260°C +6/−0°C (500°F +10/−0°F).

28.17.5 Procedure.

28.17.5.1 The specimen shall be suspended by metal hooks at the top and centered in the oven so that the entire specimen is not less than 50 mm (2 in.) from any oven surface or other specimen and air is parallel to the plane of the material.

28.17.5.2 The oven door shall not remain open more than 15 seconds. The air circulation shall be shut off while the door is open and turned on when the door is closed. The total oven recovery time after the door is closed shall not exceed 30 seconds.

28.17.5.3 The specimen mounted as specified, shall be exposed in the test oven for 5 minutes +0.15/−0 minute. The test exposure time shall begin when the test thermocouple recovers to a temperature of 260°C, +6°/−0°C (500°F, +10°/−0°F).

28.17.5.4 Immediately after the specified exposure, the specimen shall be removed and examined for evidence of ignition, melting, dripping, or separation.

28.17.6 Report. Observations of ignition, melting, dripping, or separation shall be recorded and reported for each specimen.

28.17.7 Interpretation. Where applicable, any evidence of ignition, melting, dripping, or separation on any specimen shall constitute failing performance.

28.17.8 Specific Requirements for Testing Webbing.

28.17.8.1 Samples for conditioning shall include specimens at least 380 mm (15 in.) in length.

28.17.8.2 Testing shall be performed as specified in 28.17.2 through 28.17.7.

28.17.9 Specific Requirements for Testing Label Materials.

28.17.9.1 Where attached to textile material, samples for conditioning shall include specimens attached to the textile layer as used in the harness or belt positioned no closer than 50 mm (2 in.) apart in parallel strips. The textile material shall be at least 1 m (1 yd) square of the textile layer on which the specimens are attached.

28.17.9.2 Where attached to webbing, samples for conditioning shall include specimens attached to the webbing as used in

the harness or belt positioned no closer than 50 mm (2 in.) apart. The webbing shall be at least 380 mm (15 in.) in length.

28.17.9.3 Testing shall be performed as specified in 28.17.2 through 28.17.7.

28.17.10 Specific Requirements for Testing Hardware.

28.17.10.1 A minimum of three complete hardware items shall be tested.

28.17.10.2 Observations of hardware condition following heat exposure shall be limited to ignition.

28.17.10.3 Hardware shall be evaluated for functionality within 10 minutes following removal from the oven.

28.17.10.4 Testing shall be performed as specified in 28.17.2 through 28.17.7.

28.17.11 Specific Requirements for Testing Other Materials.

28.17.11.1 Samples for conditioning shall be at least 1 m (1 yd) square of each material.

28.17.11.2 Each specimen shall be 380 mm × 380 mm ± 13 mm (15 in. × 15 in. ± ½ in.) and shall be cut from the fabric to be utilized in the construction of the item.

28.17.11.3 Testing shall be performed as specified in 28.17.2 through 28.17.7.

Chapter 29 Selection, Care, and Maintenance Program (NFPA 1858)

29.1 Administration.

29.1.1 Scope.

29.1.1.1 Chapters 29 through 35 shall specify the minimum selection, care, and maintenance requirements for rope and associated equipment that are compliant with Chapters 24 through 28.

29.1.1.2 Chapters 29 through 35 shall also specify minimum selection, care, and maintenance requirements for rope and associated equipment that are compliant with the previous editions of NFPA 1983.

29.1.1.3 Chapters 29 through 35 shall not specify selection, care, and maintenance requirements for any accessories that could be attached to the certified product and are not necessary for the certified product to meet the requirements of this standard.

29.1.1.4 Chapters 29 through 35 shall not specify selection, care, and maintenance requirements for any rope or equipment for fall protection or coworker-assisted rescue pertaining to employees of general industry or the construction and demolition industry.

29.1.1.5 Chapters 29 through 35 shall not be construed as addressing all the safety concerns associated with the use of life safety rope and equipment. It shall be the responsibility of the persons and organizations that use compliant life safety rope and equipment to establish safety and health practices and to determine the applicability of regulatory limitations prior to use.

29.1.1.6 Chapters 29 through 35 shall not be construed as addressing all the safety concerns, if any, associated with the use of this standard by testing or repair facilities.

29.1.1.7 Nothing herein shall restrict any jurisdiction from exceeding these minimum requirements.

29.1.2 Purpose.

29.1.2.1 The purpose of Chapters 29 through 35 shall be to establish a program for life safety rope and equipment to reduce the risks and hazards associated with the selection, maintenance, improper use of, or damage to life safety rope and equipment.

29.1.2.2 The purpose of Chapters 29 through 35 shall also be to establish basic criteria for selection, inspection, cleaning, decontamination, repair, storage, and retirement of rope and associated equipment that are compliant with Chapters 24 through 28.

29.1.3 Application.

29.1.3.1 Chapters 29 through 35 shall apply to life safety rope, escape rope, fire escape rope, fire escape webbing, escape webbing, throwlines, moderate elongation laid life saving rope, life safety harnesses, belts, auxiliary equipment, litters, and victim extrication devices certified as compliant with Chapters 24 through 28.

29.2 General.

29.2.1 The organization shall develop and implement a program for the selection, care, and maintenance of life safety rope and equipment that is retained for use by the members of the organization in the performance of their assigned functions.

29.2.2 This program shall have as its goal the provision and retention of life safety rope and equipment with the understanding that the following apply:

(1) Equipment shall be suitable and appropriate for the intended use.
(2) Life safety rope and equipment shall be maintained in a safe, usable condition.
(3) Equipment selection and care shall be made with the intent to provide protection to the user.
(4) The organization shall remove from use such life safety rope and equipment that, because of its condition, could cause or contribute to user injury, illness, or death.
(5) Practices for reconditioning, repairing, or retiring life safety rope and equipment shall be in accordance with manufacturer guidelines.

29.2.3 This program for the selection, care, and maintenance of life safety rope and equipment shall be implemented into an organization's overall program on protective clothing and protective equipment.

29.2.4 The portion(s) of the organization's overall program that affects life safety rope and equipment shall be in accordance with Section 29.3.

29.3 Program Organization for Life Safety Rope and Equipment.

29.3.1 The organization's program specified in Section 29.2 shall incorporate at least the requirements in Chapters 29 through 35 of this standard.

29.3.2 The organization shall develop written standard operating procedures (SOPs) that identify and define the various parts of the program, specified in Table 29.3.2; roles and responsibilities of the organization and of individuals responsible for the program parts shall be clearly communicated.

29.3.3 The organization shall develop specific criteria for removal of life safety rope and equipment from service, in accordance with Chapter 35.

29.3.3.1 Specific criteria for removal of life safety rope and equipment from service shall include the following:

(1) Issues that are specific to the life safety rope and equipment being used by the organization
(2) The manufacturer's instructions
(3) The experience of the organization
(4) Age of the equipment
(5) Time in service for the equipment

29.4 Records.

29.4.1 The organization shall compile and maintain relevant records on its life safety rope and equipment in such a manner that information is readily traceable.

29.4.2* At least the following records shall be kept for each life safety rope and equipment item:

(1) Equipment individual identification
(2) Date of purchase
(3) Date placed in service
(4) Manufacturer's contact information
(5) Item model number
(6) Month and year of manufacture
(7) Dates of use, including how used, weather conditions, potential damage, and other circumstances relating to use
(8) Dates of cleaning and inspection
(9) Removal from service and date of return
(10) Other notes deemed relevant by the AHJ

29.5 Manufacturer's Instructions.

29.5.1 When issuing new life safety rope and equipment, the organization shall provide users with the instructions provided by the manufacturer pertaining to care, use, and maintenance of the life safety rope and equipment, including any warnings and limitations statements.

29.5.2 Where the manufacturer's instructions regarding the care or maintenance of the life safety rope and equipment differ from a specific requirement(s) in this standard, the manufacturer's instructions shall supersede the requirements of Chapters 31 through 35.

29.5.3 The organization shall retain and make accessible to end users for reference purposes a copy of the manufacturer's instructions regarding the care, use, and maintenance of the life safety rope and equipment.

29.6 Product Failure.

29.6.1 The organization shall report to the manufacturer and the certification organization all life safety rope and equipment health and safety concerns that are suspected to have been caused by a known or suspected product failure.

29.6.2* The organization shall notify the manufacturer and the certification organization in writing of suspected product failure.

29.6.3 When communicating with the manufacturer and certification organization regarding suspected product failure, the organization shall request that the recipient provide written acknowledgment within 30 days.

Table 29.3.2 Required Program Parts for Life Safety Rope and Equipment

Program Part	Chapter/Section
Records	Section 29.4
Selection	Chapter 30
Inspection	Chapter 31
Cleaning and decontamination	Chapter 32
Repair	Chapter 33
Storage	Chapter 34
Retirement and disposition	Chapter 35

Chapter 30 Selection (NFPA 1858)

30.1 Selection and Purchase.

30.1.1* Prior to starting the selection process for life safety rope and equipment, the organization shall perform a hazard analysis and risk assessment for their response area relative to the technical rescue disciplines identified by Chapters 4 through 23 (NFPA 1670, incorporated in the 2022 edition of this standard).

30.1.1.1 Based on this analysis, the organization shall determine the level at which the organization trains and responds to meet the requirements established by the AHJ for each technical rescue discipline.

30.1.2 The organization shall refer to its hazard analysis and risk assessment of the response area to help determine the types of life safety rope and equipment that are encountered.

30.1.2.1 The hazard analysis and risk assessment shall include the following:

(1)* Type of technical rescue incidents likely to occur in the response area
(2) Type of technical rescue incidents to which the organization plans to respond
(3) Frequency of each of these types of incidents
(4) Level of operational capability that the organization intends to maintain for each type of technical rescue incident — awareness, operational, technician — in accordance with Chapters 4 through 23
(5) Response capabilities maximized through cooperation with other response organizations, departments, or agencies
(6)* The organization's established acceptable safety factors for technical rescue operations
(7)* Geographic location and conditions

30.1.3* The organization shall refer to its hazard analysis and risk assessment of the response area to determine the organization's protocols for an emergency escape from an elevated location in accordance with NFPA 1500.

30.1.4* The organization shall ensure that items of equipment under consideration are certified as being compliant with Chapters 24 through 28 as it applies to their intended response.

30.1.4.1 Where equipment is selected that is outside the scope of compliance with Chapters 24 through 28, the AHJ shall make note of the exception, reasons for it, and alternative means by which safety will be maintained.

30.1.5 Based on the levels of operational capability established by the AHJ, the organization shall compile and evaluate information on the comparative advantages and disadvantages of the life safety rope and equipment under consideration as it relates to their specific environment or circumstances.

30.1.6 The organization shall ensure that life safety rope and equipment items under consideration interface properly with other personal protective items and life safety equipment in use within the organization.

30.1.7 Where a field evaluation of life safety rope and equipment is conducted, the organization shall establish criteria to ensure a systematic method of comparing products in a manner related to their intended use and assessing the products' performance relative to the organization's expectations and intended use.

30.1.8 Where the organization develops purchase specifications, the following criteria shall be included:

(1) Compliance with Chapters 24 through 28
(2) In the event that equipment is required for which there is no NFPA certification, detailed performance specifications
(3) Where the organization selects criteria that exceed the minimum requirements of the current edition of Chapters 24 through 28, such criteria to be stipulated in the purchase specifications
(4) Purchase specifications that require manufacturers' bids to include substantiation of certification for each product and model stated in the bid
(5) Where applicable, that purchase specifications define the process for determining proper compatibility with the organization's other NFPA 1983–compliant life safety rope and equipment components, incorporated in the 2022 edition of this standard
(6) That the organization compares each bid submittal against purchase specifications
(7) That the intended use of the equipment provides for rescuer and victim safety

30.1.9 Prior to placing life safety rope and equipment in service, the organization shall designate an individual to inspect purchased life safety rope and equipment to determine that the correct products were shipped, that they meet the organization's specifications, and that they were not damaged during shipment.

30.1.9.1 The organization shall also verify the quantity and sizes of the life safety rope and equipment received.

30.1.10* The organization shall examine information supplied with the products, such as instructions, warranties, and technical data, to verify that it meets the requirements specified prior to purchase.

30.1.11 Before placing new equipment into service, the organization shall appoint a competent person to inspect and determine that all components are compatible and will function as intended with the technical rescue systems and escape systems on which the organization's personnel are trained in accordance with NFPA 1006.

30.1.12 Procedures shall be established for returning unsatisfactory products or products that do not meet the organization's specifications.

30.2 Life Safety Rope. The organization's purchase specifications for life safety rope shall consider the need for performance or features in excess of the minimum requirements specified in 30.2.1 through 30.2.13.

30.2.1* Specific performance criteria or specific features shall be defined based upon the intended application of the rope and equipment being purchased. If the organization has multiple intended applications for life safety rope, the purchase of multiple ropes shall be considered that best fit those applications.

30.2.2* Type of fiber, including but not limited to nylon, polyester, or para-aramid, shall be considered and selection made based upon the best choice for the organization.

30.2.3* Construction shall be considered with respect to the relative performance characteristics in accordance with CI 1202, *Terminology for Fiber Rope.*

30.2.4* Elongation shall be considered relative to the intended use and need for stability in lowering, raising, or ascending operations as compared with the need for force absorption.

30.2.5* Organizations shall specify and select rope with a minimum breaking strength (MBS) that is sufficient to provide an adequate factor of safety, as defined by the AHJ, for the intended application(s) to ensure adequate strength.

30.2.6* Rope diameter shall be considered with prioritization to ensure compatibility with the other components used in the system and the ability to grip the rope.

30.2.7* The total weight of the rope shall be considered with respect to how easy it will be to carry, as contrasted with weight-adding characteristics such as length, diameter, and material of the rope.

30.2.8* The hand shall be considered for ease of tying knots, smoothness running through gear, durability, and abrasion resistance.

30.2.9 The use of rescue-specific gloves shall be evaluated in the interaction of the rope and various components.

30.2.10* The rope color shall be considered for the ability to be seen or camouflaged, the ability for one rope to be distinguished from another when rigged side by side, and the ability to visually gauge the rate and speed of moving rope through a device.

30.2.11* The length of rope shall be considered to ensure sufficient lengths to rig the longest anticipated site in a manner consistent with standard operating procedures of the organization and with additional rope length for anchoring, mechanical advantage systems, or other rigging needs.

30.2.12* The heat resistance shall be considered.

30.2.13* For construction that includes a sheath, the sheath shall be considered, including the number of yarns, braid pattern, thickness, and tightness as they apply to the hand; ease

of use of the rope and abrasion resistance; and the amount of sheath slippage.

30.2.14 The abrasion resistance to sharp edges and rough surfaces.

30.3* Escape and Fire Escape Rope. The organization's purchase specifications for escape and fire escape rope shall be confirmed by a third party as meeting the requirements of Chapters 24 through 28 and consider the need for performance or features in excess of the minimum requirements.

30.3.1* The organization shall consider test results to determine rope performance, taking the factors in 30.3.1.1 into consideration when making the evaluations.

30.3.1.1 Escape rope, fire escape rope, and equipment shall be available as individual NFPA 1983–compliant components or NFPA 1983–compliant escape systems, incorporated in the 2022 edition of this standard. The organization shall ensure that components, manufactured systems, and any other associated personal protective equipment (PPE) are compatible based on the following performance factors:

(1)* Selection of fire escape rope if the anticipated environment will expose the rope to elevated temperatures.
(2)* Type of termination at the anchor end of the rope, including how it affects system strength
(3)* Compatibility with the descent control device
(4)* Ability to control the descent with the devices selected and with respect to type of gloves worn.
(5)* Ability of the escape rope or escape system to absorb energy in a fall.
(6)* Whether the AHJ has determined that the body belay or similar method is to be used as the escape or bail-out method of the organization.

30.3.2 The organization shall consider the manner of use in selecting escape rope, with the understanding that specific applications or environments dictate different needs.

30.3.2.1 The following shall be considered:

(1)* The type, height, and nature of manmade structures and geologic features in the organization's response area in order to determine the appropriate length of rope
(2)* How the escape rope will be worn or carried and its effect on user's ability to deploy the escape rope
(3) The effect of deployment hazards, including edge abrasion and sharp edges from windows and structural components
(4)* The expected number of descents, including training and expected service life of the escape rope

30.4* Life Safety Harness. The organization's purchase specifications for life safety harness shall meet the requirements of Chapters 24 through 28 and consider the need for performance or features specified in 30.4.1 through 30.4.7.

30.4.1* The organization shall select a Class II or Class III, or both, harness depending on the type of life safety operations the users will be conducting.

30.4.2* The organization shall select the attachment point or points appropriate for the intended use of the harness based on type, location, and the resulting impact on usability and convenience.

30.4.3* The organization shall evaluate the harness for comfort, ease of donning, fit, and ability to buddy-check.

30.4.4* The organization shall consider whether a harness constructed of specialized materials is necessary, particularly if the harness will be exposed to heat, flame, chemicals, or water.

30.4.5 The organization shall evaluate which accessories to select, if any, with consideration toward maximizing the usefulness of the harness, including gear loops, pockets, or methods for holding the loose ends of the webbing.

30.4.6* The organization shall evaluate the function of each type of harness selected in the manner that it will be used, including buckle operation, connection points, and other usability factors.

30.4.7 Where a harness is integrated with bunker gear ensemble, it shall not compromise the integrity of the protective garment as outlined in NFPA 1971.

30.5* Ladder Belts and Escape Belts. The organization's purchase specifications shall prioritize selection of NFPA-compliant ladder belts or escape belts and consider the need for performance or features specified in 30.5.1 through 30.5.8.

30.5.1 If the organization selects a belt for fall restraint during ladder operations, the organization shall select a ladder belt.

30.5.2* If the organization selects a belt rather than a harness for fireground or elevated operations, the organization shall select an escape belt.

30.5.3* The organization shall select the attachment point or points appropriate for the intended use of the belt based on type and location.

30.5.4* The organization shall evaluate belts for comfort and for ease of donning in the intended manner of use.

30.5.5* The organization shall consider the use of materials in the construction if the belt will be exposed to heat, flame, and chemicals.

30.5.6* The organization shall evaluate which accessories to select to maximize the usefulness of the belt.

30.5.7* The organization shall evaluate the function of each type of belt selected in the manner that it will be used.

30.5.8 Where an escape belt is integrated with bunker gear ensemble, it shall not compromise the integrity of the protective garment as outlined in NFPA 1971.

30.6* Carabiners. The organization's purchase specifications shall prioritize selection of carabiners that meet the requirements of Chapters 24 through 28 and consider the need for performance or features in excess of the minimum requirements specified in 30.6.1 through 30.6.4.

30.6.1* The organization shall determine whether a general-use- or a technical-use-rated carabiner is most applicable, depending on the performance needs determined by the risk assessment and the organization's needs, training, and capabilities.

30.6.2* The organization shall select the type of gate function that meets the operational needs of the organization.

30.6.3* The organization shall select the carabiner material, including elements, that meets the operational needs of the organization regarding carabiner strength and exposure to corrosive atmospheres.

30.6.4* The organization shall select the size and shape of the carabiner that best meets the operational needs of the organization.

30.7* Rope Grabs and Ascenders. The organization's purchase specifications shall prioritize selection of rope grabs and ascenders that meet the requirements of Chapters 24 through 28 and consider the need for performance or features in excess of the minimum requirements specified in 30.7.1 through 30.7.4.

30.7.1* The organization shall determine where requirements for a general-use- or technical-use-rated rope grab are most applicable depending on the performance needs determined by the risk assessment and the organization's needs, training, and capabilities.

30.7.2* The organization shall select the type of rope-gripping function that meets the operational needs of the organization with respect to host rope and other components.

30.7.3* The organization shall select the rope grab material that meets the operational needs of the organization relative to carabiner strength and exposure to corrosive atmospheres.

30.7.4* The organization shall select the rope grab shape that meets the operational needs of the organization regarding strength of the device and possible rope damage under high loads, with different selections being potentially appropriate even within the same system.

30.8 Throwlines. The organization's purchase specifications shall prioritize selection of throwlines that meet the requirements of Chapters 24 through 28 and consider the need for performance or features in excess of the minimum requirements specified in 30.8.1 through 30.8.6.

30.8.1* The organization shall determine whether the intended use of a throwline will require greater than the minimum performance specification for tensile strength listed in Chapters 24 through 28.

30.8.2* The organization shall evaluate the throwline's capabilities and limitations based on the diameter as listed in Chapters 24 through 28.

30.8.3* The organization shall determine the intended use of a throwline and the relative importance of its ability to float as listed in Chapters 24 through 28.

30.8.4* The organization shall select a throwline that will handle well during the intended use.

30.8.5* The organization shall determine what length throwline will meet the requirements of the intended use.

30.8.6* The organization shall select throwline storage that will meet the requirements of the intended use.

30.9 Descent Control Devices. The organization's purchase specifications shall prioritize selection of descent control devices that meet the requirements of Chapters 24 through 28 and consider the need for performance or features in excess of the minimum requirements for descent control devices specified in 30.9.1 through 30.9.5.

30.9.1* The organization shall determine the operational requirements of the descent control device for the following actions:

(1) Nonemergency rappel or single-person descent
(2) Emergency rappel or bailout
(3) For lowering a rescuer, a litter, or both
(4) Belay device
(5) Any combination of the above

30.9.2* The organization shall determine the selection of general-use- or technical-use-rated descent control devices based on anticipated loads, acceptable safety margins as established by the AHJ, and the experience level of the rescuers.

30.9.3* The organization shall evaluate the following design and performance specifications to determine the descent control device or devices that meet its requirements,

(1) Manual device or autolocking device
(2) Size and weight of the device
(3) Compatibility with the organization's life safety ropes for rappel or belay
(4) Compatibility with the organization's escape rope or webbing
(5) Material of construction
(6) Ability to dissipate heat

30.9.4* The organization shall evaluate the following features based on levels of personnel competency and training to determine the descent control device or devices that meet its requirements:

(1) Pre-rigged or assembled on scene
(2) Panic stop
(3) Methods of use: rigging the life safety rope, adjusting friction, locking off, knot pass, changing system direction

30.9.5* The organization shall evaluate the function of each descent control device selected by the department in the manner in which it will be used while the evaluator is wearing the clothing and PPE for that operation.

30.10* Portable Anchors. The organization's purchase specifications shall prioritize selection of portable anchors that meet the requirements of Chapters 24 through 28 and consider the need for performance or features in excess of the minimum requirements specified in 30.10.1 through 30.10.6.

30.10.1* The organization shall determine the need for a portable anchor device based on a risk assessment, equipment needs, training, and the organization's response capabilities.

30.10.2* The organization shall determine the selection of general-use- or technical-use-rated portable anchors based on anticipated loads, acceptable safety margins as established by the AHJ, and the experience level of the rescuers.

30.10.3* The portable anchor shall be evaluated by the organization for a means to package and store the device.

30.10.4* The portable anchor shall be evaluated by the organization for component assembly.

30.10.5* The portable anchor shall be evaluated by the organization for the adjustability to meet the anticipated types of incidents.

30.10.6* The organization shall evaluate how the portable anchor will be secured based on the surfaces encountered during the anticipated incidents.

30.11* Pulleys. The organization's purchase specifications shall prioritize selection of pulleys that meet the requirements of Chapters 24 through 28 and consider the need for perform-

ance or features in excess of the minimum requirements specified in 30.11.1 through 30.11.3.

30.11.1* The organization shall determine the need for pulleys based on a risk assessment, equipment needs, training, and response capabilities.

30.11.2* The organization shall determine the selection of general-use- or technical-use-rated pulleys based on anticipated loads and acceptable safety margins as established by the AHJ as well as the experience level of the rescuers.

30.11.3* The organization's selection of pulleys shall be based on the intended use, and the following criteria shall be considered:

(1) Efficiency
(2) Single or double
(3) Ratchet
(4) Overall dimensions
(5) Sheave width
(6) Sheave diameter
(7) Strength
(8) Compatibility with rope
(9) Whether sealed to protect against dirt and grime

30.12* Belay Devices. The organization's purchase specifications shall prioritize selection of belay devices that meet the requirements of Chapters 24 through 28 and consider the need for performance or features in excess of the minimum requirements specified in 30.12.1 through 30.12.5.

30.12.1* The organization shall determine the selection of general-use- or technical-use-rated belay devices based on anticipated loads and acceptable safety margins as established by the AHJ and the experience level of the organization's rescuers.

30.12.2* The organization shall determine a maximum arrest distance for any belay system used in different systems and establish arrest distances.

30.12.3* Organizations shall set the maximum allowable system capacity, given system configuration and methods used, so as to not exceed the capabilities of the belay device.

30.12.4* The organization shall select a belay device that is within the operational and training levels of the users.

30.12.5* The organization shall consider belay device performance in operational conditions, such as weight and environment.

30.13* End-to-End and Multiple Configuration Straps. The organization's purchase specifications for end-to-end and multiple configuration straps shall meet the requirements of Chapters 24 through 28 and consider the need for performance or features in excess of the minimum requirements specified in 30.13.1 through 30.13.3.

30.13.1* The organization shall determine the number of general-use- or technical-use-rated end-to-end and multiple configuration straps required and how they are to be implemented based on anticipated loads and acceptable safety margins as established by the AHJ as well as the experience level of the organization's rescuers.

30.13.2* The organization's selection of end-to-end and multiple configuration straps shall be based on the intended use and shall consider the following performance and design features:

(1) Length
(2) Width
(3) Weight
(4) Terminations
(5) Material
(6) Adjustability
(7) Color
(8) Slip

30.13.3* The organization shall evaluate the performance of end-to-end and multiple configuration straps in the manner of intended use as specified by the manufacturer.

30.14* Litters. The organization's purchase specifications for litters shall meet the requirements of Chapters 24 through 28 and consider the need for performance or features in excess of the minimum requirements specified in 30.14.1.

30.14.1* The organization's selection of litters shall be based on the intended use and shall consider the following performance and design features:

(1) Material of construction
(2) One-piece or two-piece design
(3) Rigid or semi-rigid design
(4) Integrated attachment points
(5) Means of securing victim
(6) Shape of litter
(7) Size of litter
(8) Litter accessories
(9) Means of connecting to the litter
(10) Convenience for litter handlers

30.15 Manufactured Systems. The organization's purchase specifications for manufactured systems shall meet the requirements of Chapters 24 through 28 and consider the need for performance or features in excess of the minimum requirements specified in 30.15.1 and 30.15.2.

30.15.1 The organization shall refer to the appropriate sections of this document for information regarding the choices of components that compose a manufactured system.

30.15.2* The organization shall evaluate the performance of the manufactured system in the manner of intended use relative to the types of operations it is likely to perform.

30.15.3 The organization shall evaluate its needs with respect to removable components and ensure the system is compatible with these needs.

30.16* Escape and Fire Escape Systems. The organization's purchase specifications for escape systems shall meet the requirements of Chapters 24 through 28 and consider the need for performance or features in excess of the minimum requirements specified in 30.16.1 through 30.16.13.

30.16.1* The organization shall consider the manner of use and intended environment of the escape system.

30.16.2* The organization shall consider selecting a system that is preconnected to the firefighter or will be connected immediately prior to use.

30.16.3* The organization shall consider selecting an escape-rope-based system or an escape-webbing-based system.

30.16.4* The organization shall consider selecting a fire escape system or an escape system.

30.16.5 The organization shall consider the method of deployment that will meet the time acceptable to the organization.

30.16.6* The organization shall consider whether the payout force is within the organization's parameters.

30.16.7* The organization shall consider selecting a system that is sealed or repackable.

30.16.8* The organization shall determine whether the individual components of the escape system meet its expectations for initial training as well as recurrent training.

30.16.9* In selecting a system, the organization shall evaluate which type of descent control device best meets the level of initial training and recurrent training.

30.16.10* The organization shall evaluate the structures and hazards in its response area to determine the operational length of the rope or webbing for the escape system in order to reach the surface or a safe area.

30.16.11* In selecting a system, the organization shall evaluate which type of anchoring method best meets the levels of initial training and recurrent training and associated strength requirements.

30.16.12* The organization shall consider the use and maintenance requirements of the escape system.

30.16.13* The organization shall evaluate the function of the escape system in the manner that it will be used when the rescuer is wearing full protective clothing and PPE.

30.16.14 The organization shall evaluate its needs with respect to removable components and ensure the system is compatible with these needs, including the effects of impact forces.

30.16.15 The organization shall consider the ability of the escape system to absorb energy and reduce the load transmitted to the anchor or human body during dynamic loading events.

30.16.16* A line shall be selected based on one of the following:

(1) Fire escape rope that meets the requirements of Chapters 24 through 28
(2) Fire escape webbing that meets the requirements of Chapters 24 through 28

30.16.16.1 If a line that meets the requirements of Chapters 24 through 28 is not selected, the escape system or fire escape system shall meet the performance requirements in accordance with Chapters 24 through 28.

30.17 Escape and Fire Escape Webbing. The organization's purchase specifications for escape and fire escape webbing shall meet the requirements of Chapters 24 through 28 and consider the need for performance or features in excess of the minimum requirements specified in 30.17.1 and 30.17.2.

30.17.1* The organization shall consider the following performance factors when making the evaluations:

(1) Escape webbing, fire escape webbing, and equipment are available as individual NFPA 1983–compliant components, incorporated in the 2022 edition of this standard.
(2) Escape webbing, fire escape webbing, and equipment are available as NFPA 1983–compliant escape and fire escape systems, incorporated in the 2022 edition of this standard.

30.17.1.1 The organization shall ensure that components, escape systems, and fire escape systems, and any other associated PPE are compatible based on the following:

(1)* Fire escape webbing if the anticipated environment will expose the webbing to elevated temperatures
(2)* Type of termination at the anchor end of the webbing
(3) Compatibility with the descent control device
(4)* Ability to control the descent with the type of gloves worn
(5)* Ability of the escape webbing or escape system to absorb energy in a fall
(6)* Whether the AHJ has determined that the body belay or similar method is to be used as the escape or bail-out method of the organization

30.17.2 The organization shall consider the manner of use in the escape webbing, such as the following:

(1)* Structures in the organization's response area to determine the appropriate length of webbing
(2)* The location that the escape webbing will be worn or carried and its effect on user's ability to deploy the escape webbing
(3) The effect of deployment hazards, such as edge abrasion from windows and structural components
(4)* The number of descents and service life of the escape webbing

30.18* Escape Anchor Devices. The organization's purchase specifications for escape anchor devices shall meet the requirements of Chapters 24 through 28 and consider the need for performance or features in excess of the minimum requirements as specified in 30.18.1 and 30.18.2.

30.18.1 The organization shall refer to its risk and hazard assessment of the response area to determine the types of incidents requiring the use of an escape anchor device and which device(s) are most applicable to their use.

30.18.1.1 The organization shall consider the following:

(1)* Security when the anchor device is deployed
(2)* How the escape anchor will be carried by the firefighter
(3) The ease of deployment of the escape anchor to determine if the time to deploy is acceptable to the organization
(4)* Whether the escape anchor device is compatible with the escape rope or webbing selected by the organization
(5) The following primary and secondary locations:
    (a) Distance from window
    (b) Time it takes to set the device
    (c) Ability of individuals to set the device
    (d) Storage location

30.18.2* The organization shall evaluate the function of each escape anchor device selected by the department in the manner that it will be used while the user is wearing the clothing and PPE for that operation.

30.19* Victim Extrication Device. The organization's purchase specifications for victim extrication devices shall meet the requirements of Chapters 24 through 28 and consider the need for performance or features in excess of the minimum requirements specified in 30.19.1 through 30.19.7.

30.19.1 Because the specification, design, and performance requirements of NFPA 1983, incorporated in the 2022 edition of this standard, are limited to determining minimum device strength and the security of the patient, the organization shall refer to its medical control or standards to comply with medical specifications, requirements, or performance metrics.

30.19.2* The organization shall determine the specific needs for selecting a victim extrication device by evaluating the device for multiple rescue situations based on response.

30.19.3* The organization shall determine whether a Class II or a Class III victim extrication device is required to meet its victim extrication requirements.

30.19.4* Victim extrication devices shall be evaluated based on ease of use, construction features, ease of transportation to rescue site, ease of deployment, and storage requirements.

30.19.4.1 Evaluation on ease of use of these shall be performed with PPE donned and vision obscured.

30.19.5 The method of transportation of a victim with the victim extrication device shall be evaluated based on the manufacturer's instructions on intended use and the following considerations:

(1) Providing a secure means of attachment to a rope rescue system (if so equipped)
(2) Ease of packaging and securing the victim in the device by the use of straps, buckles, or other mechanisms
(3) Ease of transporting the victim in the device over various terrains, up and down stairs, and in and out of confined spaces
(4) The ability of the device to prevent unnecessary movement to the victim

30.19.6 The components of the victim extrication device shall be evaluated for the following:

(1) Durability of materials in the manner of use specified by the manufacturer
(2) For components that might be exposed to corrosive environments, resistance to corrosive forces

30.19.7 The device shall be evaluated on ease of cleaning and decontamination following the manufacturer's instructions.

30.20* Moderate Elongation Laid Life-Saving Rope. The organization's purchase specifications for moderate elongation laid life-saving rope shall meet the requirements of Chapters 24 through 28 and consider the need for performance or features in excess of the minimum requirements specified in 30.20.1 and 30.20.2.

30.20.1 Specific performance or features shall be selected based on the intended application of the rope being purchased.

30.20.2 If the organization has multiple intended applications for moderate elongation laid life-saving rope, the purchase of multiple ropes shall be considered so that equipment is chosen to best fit those applications based on the following:

(1)* Fiber type: Nylon, polyester, para-aramid
(2)* Construction: Laid construction of continuous filament yarn twisted into three or more strands
(3)* Elongation: Moderate (10 percent to 15 percent) at 10 percent MBS
(4)* Strength: Required MBS to provide a sufficient safety factor based on current NFPA guidelines
(5)* Diameter: Compatible with other components used in the system
(6)* Weight: Total weight to be carried affected by the length, diameter, and material
(7)* Hand: Ease of tying knots, smoothness running through gear, and abrasion resistance
(8)* Color: Per the requirements of the AHJ
(9)* Length: Per the requirements of the AHJ

Chapter 31 Inspection (NFPA 1858)

31.1 General.

31.1.1 The AHJ shall specify minimum requirements for training and experience necessary for a person to be a competent equipment inspector.

31.1.2 The AHJ shall develop guidance for equipment inspection, based on Chapter 31, industry best practice, manufacturer's instructions, and other relevant information.

31.1.3 Manufacturer's instructions shall be followed for all inspection, care, and maintenance.

31.1.4 Universal precautions shall be observed, as appropriate, in the handling of life safety rope and equipment that was exposed to contamination during use.

31.1.5* Any life safety rope and equipment that is found to be soiled or contaminated shall be cleaned or decontaminated before any additional inspection is initiated. If decontamination is not possible or warranted, contaminated life safety rope and equipment shall be retired.

31.1.6 The organization shall establish guidelines for its members to follow in determining if an element is soiled to an extent that cleaning is necessary.

31.1.7 The organization shall determine appropriate actions to be taken if life safety rope and equipment is found to be in need of cleaning, decontamination, or repair.

31.1.7.1 At a minimum, any necessary cleaning or decontamination shall be done in accordance with the requirements specified in Chapter 32.

31.1.7.2 At a minimum, any necessary repairs shall be made in accordance with the requirements specified in Chapter 33.

31.1.8* Age of equipment shall be taken into consideration as part of the inspection process.

31.1.8.1* The maximum lifetime of software shall be no more than 10 years from the date of manufacture.

31.2 Inspection Procedures.

31.2.1* Life safety rope and equipment shall be inspected periodically according to the organization's policy for inspecting life safety rope and equipment.

31.2.1.1 Predeployment Inspection. Prior to making the item available for service, the user shall perform a predeployment inspection as follows:

(1) A visual check shall be performed in a manner sufficient to ensure that all the components are present and none of them are compromised.

(2) Where the equipment is assigned to an individual, the predeployment inspection shall be performed prior to a duty shift.
(3) Where the equipment is not assigned to an individual, the AHJ shall determine the appropriate interval.
(4) Any deficient components shall be removed from service and subjected to a thorough inspection.

31.2.1.2 Routine Inspection. The user shall perform a routine inspection before and after each use as follows:

(1) Routine inspection shall be performed in a manner sufficient to ensure that the product is safe for use.
(2) Routine inspection shall include, at a minimum, visual and tactile inspection for mildew, wear, damage, and other deterioration.
(3) Any deficient components shall be removed from service and subjected to a thorough inspection.

31.2.1.3 Thorough Inspection. The organization shall determine at what intervals a thorough inspection is needed as follows:

(1)* Thorough inspections shall be scheduled based on use of the equipment.
(2) Thorough inspections shall be performed at least once each year and shall include a more in-depth evaluation of equipment condition, including visual and tactile, and information including, but not limited to, age, date of purchase, and usage log review.
(3) This inspection shall be documented.

31.2.2 Life safety rope and equipment shall be inspected by an inspector meeting the organization's requirements for the type of inspection conducted of life safety rope and equipment.

31.2.3 The date of the inspection and the results of the inspection shall be recorded in the appropriate log or on a tag attached to the life safety rope and equipment for that purpose.

31.2.4 Each user shall be trained to conduct a predeployment and routine inspection.

31.2.5 Inspection shall include, as a minimum, the inspections specified in 31.2.5.1 through 31.2.5.15.

31.2.5.1* Life safety rope shall be retired from service if inspection reveals damage resulting in a performance deficiency due to the following:

(1) Soiling
(2) Contamination
(3) Physical damage, including but not limited to the following:
    (a) Cuts, chaffing, broken fibers, or soft or hard spots on the sheath
    (b) Thermal or chemical damage that can be detected by sight, feel, or smell, such as melted fibers, glazed surfaces, or discoloration
    (c) Any variation in the rope diameter
(4) A history in the rope log of shock load, fall load, static load, or excessive loading
(5) Excessive age

31.2.5.2* Escape and fire escape rope shall be retired from service if inspection reveals damage resulting in a performance deficiency due to the following:

(1) Soiling
(2) Contamination
(3) Physical damage, including but not limited to the following:
    (a) Cuts, chaffing, broken fibers, or soft or hard spots on the sheath
    (b) Thermal or chemical damage that can be detected by sight, feel, or smell, such as melted fibers, glazed surfaces, or discoloration
    (c) Any variation in the rope diameter
(4) A history in the rope log of shock load, fall load, static load or excessive loading
(5) Excessive age

31.2.5.3 Life safety harnesses, ladder belts, and escape belts shall be repaired or retired from service if inspection reveals damage resulting in a performance deficiency due to the following:

(1) Soiling
(2) Contamination
(3) Physical damage to the webbing components, including, but not limited to, the following:
    (a) Cuts, worn or frayed areas, broken fibers, or soft or hard spots
    (b) Thermal or chemical damage that can be detected by sight, feel, or smell, such as melted fibers, glazed surfaces, or discoloration
    (c) Pulled threads, abrasions, or breaks in the stitching
(4) Physical damage to the hardware components, including, but not limited to, the following:
    (a) Damage, sharp edges, or missing components
    (b) Failure to operate properly
(5) Excessive age

31.2.5.4 Carabiners and snap links shall be repaired or retired from service if inspection reveals damage resulting in a performance deficiency due to the following:

(1) Soiling
(2) Contamination
(3) Excessive wear
(4) Physical damage, including but not limited to the following:
    (a) Sharp edges,
    (b) Missing components
    (c) Misalignment
    (d) Cracks
    (e) Deformation
    (f) Corrosion or pitting
(5) Improper operation of the gate or locking mechanism

31.2.5.5 End-to-end and multiple-configuration straps shall be repaired or retired from service if inspection reveals damage resulting in a performance deficiency due to the following:

(1) Soiling
(2) Contamination
(3) Physical damage to the webbing components, including, but not limited to, the following:
    (a) Cuts, worn or frayed areas, broken fibers, or soft or hard spots
    (b) Thermal or chemical damage that can be detected by sight, feel, or smell, such as melted fibers, glazed surfaces, or discoloration
    (c) Pulled threads, abrasions, or breaks in the stitching

(4) Physical damage to the hardware components, including, but not limited to, the following:
    (a) Damage, sharp edges, or missing components
    (b) Failure to operate properly
(5) History of shock load, fall load, or static load in excess of the design load
(6) Excessive age

31.2.5.6 Rope grabs and ascending devices shall be repaired or retired from service if inspection reveals damage resulting in a performance deficiency due to the following:

(1) Soiling
(2) Contamination
(3) Excessive wear
(4) Physical damage, including but not limited to the following:
    (a) Sharp edges
    (b) Missing components
    (c) Misalignment
    (d) Cracks
    (e) Deformation
    (f) Corrosion or pitting
(5) Improper operation of the cam or rope gripping component

31.2.5.7 Throwlines shall be repaired or retired from service if inspection reveals damage resulting in a performance deficiency due to the following:

(1) Soiling
(2) Contamination
(3) Physical damage, including but not limited to the following:
    (a) Cuts, chaffing, broken fibers, or soft or hard spots on the sheath
    (b) Thermal or chemical damage that can be detected by sight, feel, or smell, such as melted fibers, glazed surfaces, or discoloration
    (c) Any variation in the rope diameter
(4) A history in the rope log of shock load, fall load, static load, or excessive loading
(5) Loss of floatability

31.2.5.8 Descent control devices and belay devices shall be repaired or retired from service if inspection reveals damage resulting in a performance deficiency due to the following:

(1) Soiling
(2) Contamination
(3) Excessive wear
(4) Physical damage, including but not limited to the following:
    (a) Sharp edges
    (b) Missing components
    (c) Misalignment
    (d) Cracks
    (e) Deformation
    (f) Corrosion or pitting
(5) Improper operation of the gate or locking mechanism

31.2.5.9 Portable anchors shall be repaired or retired from service if inspection reveals damage resulting in a performance deficiency due to the following:

(1) Soiling
(2) Contamination
(3) Excessive wear
(4) Physical damage, including but not limited to the following:
    (a) Sharp edges
    (b) Missing components
    (c) Misalignment
    (d) Cracks
    (e) Deformation
    (f) Corrosion or pitting
(5) Improper operation of the gate or locking mechanism

31.2.5.10 Pulleys shall be repaired or retired from service if inspection reveals damage resulting in a performance deficiency due to the following:

(1) Soiling
(2) Contamination
(3) Excessive wear
(4) Physical damage, including but not limited to the following:
    (a) Sharp edges
    (b) Missing components
    (c) Misalignment
    (d) Cracks
    (e) Deformation
    (f) Corrosion or pitting
(5) Improper operation of the gate or locking mechanism

31.2.5.11 Litters and victim extrication devices shall be repaired or retired from service if inspection reveals damage resulting in a performance deficiency due to the following:

(1) Soiling
(2) Contamination
(3) Excessive wear
(4) Physical damage, including but not limited to the following:
    (a) Sharp edges
    (b) Missing components
    (c) Misalignment
    (d) Cracks
    (e) Deformation
    (f) Corrosion or pitting
(5) Improper operation of the gate or locking mechanism

31.2.5.12 Escape and fire escape webbing shall be retired from service if inspection reveals damage resulting in a performance deficiency due to the following:

(1) Soiling
(2) Contamination
(3) Physical damage, including but not limited to the following:
    (a) Cuts, chaffing, broken fibers, or soft or hard spots on the sheath
    (b) Thermal or chemical damage that can be detected by sight, feel, or smell, such as melted fibers, glazed surfaces, or discoloration
    (c) Any variation in the rope diameter
(4) A history in the rope log of shock load, fall load, static load, or excessive loading

31.2.5.13 Escape anchor devices shall be repaired or retired from service if inspection reveals damage resulting in a performance deficiency due to the following:

(1) Soiling

(2) Contamination
(3) Excessive wear
(4) Physical damage, including but not limited to the following:
    (a) Sharp edges
    (b) Missing components
    (c) Misalignment
    (d) Cracks
    (e) Deformation
    (f) Corrosion or pitting
(5) Improper operation of the gate or locking mechanism

31.2.5.14 Moderate elongation laid life-saving rope shall be repaired or retired from service if inspection reveals damage resulting in a performance deficiency due to the following:

(1) Soiling
(2) Contamination
(3) Physical damage, including but not limited to the following:
    (a) Cuts, chaffing, broken fibers, or soft or hard spots on the sheath
    (b) Thermal or chemical damage that can be detected by sight, feel, or smell, such as melted fibers, glazed surfaces, or discoloration
    (c) Any variation in the rope diameter
(4) A history in the rope log of shock load, fall load, static load, or excessive loading

31.2.5.15 Escape systems, fire escape systems, and manufactured systems and escape systems shall be repaired or retired from service if inspection reveals damage resulting in a performance deficiency due to the following:

(1) Soiling
(2) Contamination
(3) Any component deficiency as described in 31.2.5.1 through 31.2.5.14 as applicable
(4) Incompatibility of subcomponents
(5) Missing or improperly assembled components

Chapter 32 Cleaning and Decontamination (NFPA 1858)

32.1 General.

32.1.1 Organizations shall provide a means for having life safety rope and equipment cleaned and decontaminated.

32.1.1.1 Universal precautions shall be followed throughout the cleaning and decontamination process.

32.1.1.2 Where possible, organizations shall refer to the manufacturer's recommendations for cleaning and decontamination of life safety rope and equipment.

32.1.2* Life safety rope and equipment shall be evaluated by the user, following the manufacturer's instructions, for application of appropriate cleaning level after each use.

32.1.3 Life safety rope and equipment that are known to be or suspected to be contaminated with hazardous materials shall be evaluated on the incident scene by members of the organization authorized to conduct a preliminary assessment of the extent of contamination and the need for life safety rope and equipment to be isolated, tagged, and bagged on scene.

32.1.3.1 Contaminated life safety rope and equipment shall be isolated during the incident personnel decontamination process and removed from service until the contaminant or suspected contaminant is identified and the equipment can receive specialized cleaning as necessary to remove the specific contaminant(s).

32.1.3.2 Where possible and where the contaminant and its source have been identified, the organization shall consult the supplier of the contaminant and the manufacturer of the life safety rope and equipment for the appropriate decontamination agent and process.

32.1.3.3 A member of the organization who has received training in the cleaning and decontamination of life safety rope and equipment shall be responsible for performing or managing decontamination of life safety rope and equipment.

32.1.4 Life safety rope and equipment that are known to be or suspected to be contaminated with body fluids shall be evaluated on the incident scene by members of the organization authorized to conduct a preliminary assessment of the extent of contamination and the need for the life safety rope and equipment to be isolated, tagged, and bagged at the incident scene.

32.1.5 Organizations shall have written procedures detailing the decontamination and cleaning processes for life safety rope and equipment contaminated with body fluids. Universal precautions shall be observed at all times by members handling life safety rope and equipment known to be or suspected to be contaminated with body fluids.

32.1.6 Soiled or contaminated life safety rope and equipment shall not be brought into a home, washed in a home laundry, or washed in a public laundry unless the public laundry has a dedicated business to handle life safety rope and equipment.

32.1.7 If the organization does not have a means to decontaminate life safety rope, webbing, or other absorbent equipment, the contaminated life safety rope and equipment shall be disposed of following the organization's procedure for the disposal of equipment contaminated by hazardous materials or body fluids.

32.2 Cleaning.

32.2.1 The organization shall be responsible for the routine cleaning of life safety rope and equipment.

32.2.2 Organizations shall examine the manufacturer's label and user information that the manufacturer provided with the life safety rope and equipment for instructions on cleaning and drying. In the absence of manufacturer's instructions or manufacturer's approval of alternative procedures for the life safety rope and equipment, the routine cleaning and drying procedures provided in this section shall be used.

32.2.3 Routine Cleaning Process for Life Safety Rope and Webbing.

32.2.3.1 The organization shall determine its requirements for when rope or webbing shall be cleaned.

32.2.3.2 In the absence of manufacturer's instructions, the cleaning procedure shall be as follows:

(1) Remove as much debris, dirt, and mud as possible at the scene.
(2) Rinse off any excess dirt with a hose.
(3) Soak the rope or webbing for a minimum of 30 minutes in a plastic tub of water with mild detergent added.

(4) Rinse the rope or webbing by pulling it through a rope washing device twice.
(5) Hang the rope or webbing in a cool, shady place to dry.

32.2.4* Decontamination of Rope and Webbing.

32.2.4.1 The organization shall determine requirements pertaining to rope or webbing being taken out of service due to contamination.

32.2.4.2 Rope or webbing that has come into contact with blood or other body fluids shall be decontaminated using detergents or cleaning agents approved for removing biohazards according to the organization's protocols for decontaminating PPE.

32.2.5 Routine Cleaning Process for Equipment.

32.2.5.1 The organization shall determine its requirements for when equipment shall be cleaned.

32.2.5.2 In the absence of manufacturer's instructions, the cleaning procedure shall be as follows:

(1) Remove as much debris, dirt, and mud as possible at the scene.
(2) Rinse any soft goods to remove excess dirt.
(3) Hang soft goods in a cool, shady place to dry.
(4) Wipe any hard goods with a soft cloth.
(5) Ensure any moving parts remain functional.

32.2.5.3* If lubrication of moving parts is necessary, a dry or nonstick lubricant shall be used following cleaning.

32.2.6 Decontamination of Equipment.

32.2.6.1 The organization shall determine the requirements pertaining to equipment being taken out of service due to contamination.

32.2.6.2 Equipment that has come into contact with blood or other body fluids shall be decontaminated using disinfectants or sanitizers approved for removing biohazards according to the organization's protocols for decontaminating PPE.

Chapter 33 Repair (NFPA 1858)

33.1 General. Life safety rope and equipment shall not be modified, repaired, or otherwise altered without explicit authorization from the manufacturer.

33.2 Rope and Webbing. When damage to rope or webbing is detected, the rope or webbing shall be removed from service and destroyed or relegated to non-life safety duty.

33.3 Other Equipment. The organization shall consult the manufacturer for other equipment repair.

Chapter 34 Storage (NFPA 1858)

34.1* Storage of Life Safety Rope, Moderate Elongation Laid Life-Saving Rope, Escape Rope, Escape Webbing, Fire Escape Rope, Fire Escape Webbing, and Throwlines.

34.1.1* Rope and webbing shall be stored in a clean, dry, well-ventilated place away from direct sunlight and away from heat.

34.1.2 Rope shall be kept off of the floor and never stored on dirt or concrete floors without ventilation underneath.

34.1.3 Rope shall never be placed in areas where acids or alkalis are stored.

34.2* Storage of Equipment. Equipment shall be stored in such a manner as to prevent damage, contact with other equipment, and exposure to chemicals and atmospheres that can contribute to rust, corrosion, or oxidation.

Chapter 35 Retirement and Disposition Procedures (NFPA 1858)

35.1* Retirement of Life Safety Software Products.

35.1.1* The organization shall develop specific criteria for the removal of software products from service based on the manufacturer's instructions and the experience of the organization.

35.1.2* Software products shall be retired in accordance with 35.2.1 no more than 10 years from the date of manufacture.

35.1.3 Software products that are not in compliance with the NFPA 1983 edition that was current when the product was manufactured shall be retired in accordance with 35.2.1.

35.1.4 Software products that are contaminated to the extent that the organization deems it not possible or cost effective to decontaminate them shall be retired in accordance with 35.2.1.

35.1.5 Software products that are no longer of use to the organization for emergency operations service but are not contaminated, defective, or damaged shall be retired in accordance with 35.2.1 or 35.2.2.

35.2* Disposition of Software Products.

35.2.1 Retired software products shall be destroyed or disposed of in a manner ensuring that they will not be used in any life safety or emergency activities, including training in accordance with ASTM F1740, *Standard Guide for Inspection of Nylon, Polyester, or Nylon/Polyester Blend, or Both Kernmantle Rope.*

35.2.2 Retired software products as determined in 35.1.5 shall be permitted to be used as follows:

(1) For training, if a software product has been inspected per 31.2.5 and meets the organization's criteria for life support
(2) As determined by the organization

35.3* Retirement of Life Safety Hardware.

35.3.1 The organization shall develop specific criteria for the removal of hardware from service based on the manufacturer's instructions and the experience of the organization.

35.3.2* Hardware that is worn or damaged to the extent that the organization deems it not possible or cost-effective to repair it shall be retired in accordance with Section 35.4.

35.4 Disposition of Hardware. Retired hardware shall be destroyed or disposed of in a manner ensuring that it will not be used in any life safety or emergency activities, including training.

Annex A Explanatory Material

Annex A is not a part of the requirements of this NFPA document but is included for informational purposes only. This annex contains explanatory material, numbered to correspond with the applicable text paragraphs.

A.1.3 An AHJ incorporating NFPA 1670, NFPA 1858, NFPA 1983, or any combination of the three, can replace those references with chapters and still reference similar content. For example, if an AHJ incorporated the 2017 edition of NFPA 1670 (i.e., in accordance with the 2017 edition of NFPA 1670) and wishes to update to the latest information, they can do so by incorporating Chapters 1 through 3, 4 through 23, and Annexes A through J of the 2022 edition of NFPA 2500 (i.e., in accordance with Chapters 1 through 3, 4 through 23, and Annexes A through J of the 2022 edition of NFPA 2500).

A.1.4 Equivalent values in parentheses should not be considered the requirement, as these values are approximate. See Table A.1.4(a) and Table A.1.4(b) for conversion factors.

A.3.2.1 Approved. The National Fire Protection Association does not approve, inspect, or certify any installations, procedures, equipment, or materials; nor does it approve or evaluate testing laboratories. In determining the acceptability of installations, procedures, equipment, or materials, the authority having jurisdiction may base acceptance on compliance with NFPA or other appropriate standards. In the absence of such standards, said authority may require evidence of proper installation, procedure, or use. The authority having jurisdiction may also refer to the listings or labeling practices of an organization that is concerned with product evaluations and is thus in a position to determine compliance with appropriate standards for the current production of listed items.

A.3.2.2 Authority Having Jurisdiction (AHJ). The phrase "authority having jurisdiction," or its acronym AHJ, is used in NFPA documents in a broad manner, since jurisdictions and approval agencies vary, as do their responsibilities. Where public safety is primary, the authority having jurisdiction may be a federal, state, local, or other regional department or individual such as a fire chief; fire marshal; chief of a fire prevention bureau, labor department, or health department; building official; electrical inspector; or others having statutory authority. For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the authority having jurisdiction. In many circumstances, the property owner or his or her designated agent assumes the role of the authority having jurisdiction; at government installations, the commanding officer or departmental official may be the authority having jurisdiction.

Table A.1.4(a) SI Unit to U.S. Unit Conversion Factor

Quantity	SI Unit (symbol)	U.S. Unit (symbol)	Conversion Factor
Force	kilonewton (kN)	pound-force (lbf)	224.81
Mass	kilogram (kg)	pound (lb)	2.6792
Length	millimeter (mm)	inch (in.)	0.03937
	centimeter (cm)	inch (in.)	0.3937
	meter (m)	foot (ft)	3.2808

Table A.1.4(b) U.S. Unit to SI Unit Conversion Factor

Quantity	U.S. Unit (symbol)	SI Unit (symbol)	Conversion Factor
Force	pound-force (lbf)	kilonewton (kN)	0.0044482
Mass	pound (lb)	kilogram (kg)	0.37324
Length	inch (in.)	millimeter (mm)	25.4
	inch (in.)	centimeter (cm)	2.54
	foot (ft.)	meter (m)	0.3048

A.3.2.4 Listed. The means for identifying listed equipment may vary for each organization concerned with product evaluation; some organizations do not recognize equipment as listed unless it is also labeled. The authority having jurisdiction should utilize the system employed by the listing organization to identify a listed product.

A.3.3.10.1 Load-Bearing Attachment Point. Load-bearing attachment points are D-rings, loops, or other connection points on a life safety harness, a victim extrication device, or an escape belt that is designated for use as the connection point to suspend the full weight of the wearer and equipment, such as where ascending or descending rope and for fall arrest where the wearer might fall and shock load the connection point. These attachment points are designed to withstand the forces generated in a fall arrest situation.

A.3.3.10.2 Positioning Attachment Point. Positioning attachment points are D-rings, loops, or other connection points on a life safety harness or belt that are designated for use solely to support the wearer's weight when connected to an anchor system. Attachment to positioning points can expose the wearer to a fall such as when using a strap connected to side D-rings when connected to a pole or tower. In other situations such as working on rappel, a fall can be much less likely. These attachment points are typically not designed to withstand the forces generated in a fall arrest situation, but can be designed for a much lower-impact fall. If the situation requires the use of fall arrest equipment, the anchor system should be attached to the main attachment point. Manufacturers should clearly identify and the user should be familiar with any attachment points that are only rated as positioning points.

A.3.3.12 Avalanche. A small, and often harmless, avalanche is called a "sluff."

A.3.3.13 Belay. This method can be accomplished by a second line in a raising or lowering system or by managing a single line with a friction device in fixed-rope ascent or descent. Belays also protect personnel exposed to the risk of falling who are not otherwise attached to the rope rescue system.

A.3.3.17.1 Escape Belt. The intended use of the escape belt is to provide emergency escape capability to a firefighter from an immediate life-threatening emergency above the ground floor of a structure. Escape belts do not have leg loops to prevent the belt from rising up the torso of the user. A firefighter using an escape belt should always be able to maintain foot contact with the surface of the structure during descent or use a life safety harness.

A.3.3.22 Body Substance Isolation. This equipment usually includes the use of fluid impervious gloves, goggles, masks, and gowns/coveralls.

A.3.3.27 Cave. Caves can breathe in and out, often creating a wind that can have a chilling effect on patients and rescuers. Caves can also include water features, including rivers, streams,

or lakes and can have deep drops, some as deep as 500 ft (152.4 m).

A.3.3.31 Cleaning. Cleaning is considered separate from the use of disinfectants and sanitizers; however, some cleaning processes might also effectively remove biological contamination. Removal of biological contamination is covered under disinfection and sanitization.

A.3.3.36 Confined Space. This definition excludes mines and caves or other natural formations, all of which must be addressed by other specialized training and equipment.

In addition to those characteristics noted in 3.3.36, a confined space also has one or more of the following characteristics:

(1) Contains or has a potential to contain a hazardous atmosphere
(2) Contains a material that has the potential for engulfing an entrant
(3) Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor that slopes downward and tapers to a smaller cross-section
(4) Contains any other recognized serious safety or health hazards (including falling, environmental, and equipment hazards)

A.3.3.42 Coverage (sometimes called "coverage factor"). Defined as the ratio of the area effectively swept to the physical area of the segment that was searched as shown in the following equation:

[A.3.3.42]

$$Coverage = \frac{Area\ effectively\ swept}{Segment's\ Area}$$

Searching an area and achieving a coverage of 1.0 means that the area effectively swept equals the area searched. Note that this does not necessarily mean that every piece of ground was scanned, nor does it mean that the probability of detection (POD) of a coverage 1.0 search is at or near 100 percent. Coverage is a measure of how thoroughly the segment was searched. The higher the coverage, the higher the POD will be. However, the relationship is not linear — that is, doubling the coverage does not double the POD.

Searcher-hours (number of searchers × time spent searching) are sometimes used to roughly suggest a level of coverage. For example, two persons spending 2 hours searching a specific property or segment could be said to have applied twice as much coverage as if two searchers spent 1 hour searching the same property or segment.

A.3.3.44 Critical Angle. When a rope (web) is connected between two points and a load placed in between, an angle is formed. This interior angle can act as a force multiplier. As the angle increases, the force directed along the rope (web) is amplified, increasing the force felt on the anchors. At 120 degrees, the force on each anchor is equivalent to the load. Beyond this point, such as with a high line, the force on each anchor rapidly increases. When a rope (web) is looped around an anchor point, a critical angle also can be formed. As the angle increases, the tension in the rope (web) increases, creating compression force on the anchor, but the tension on the anchor point remains the same. Table A.3.3.44 shows the relative force exerted on each anchor point in a two-point load-distributing anchor system where the load mass is 200 lb (90 kg) exerting 200 lbf (0.89 kN) of force at its attachment at varying angles *(also see Figure A.3.3.44)*.

Table A.3.3.44 Two-Point Anchor Systems Showing Relative Force

Angle (degrees)	Force at Each Anchor	
	lbf	kN
0	100	0.44
30	103	0.46
45	108	0.48
60	115	0.51
90	141	0.63
120	200	0.89
160	575	2.56
170	1,147	5.10
179	11,459	50.97

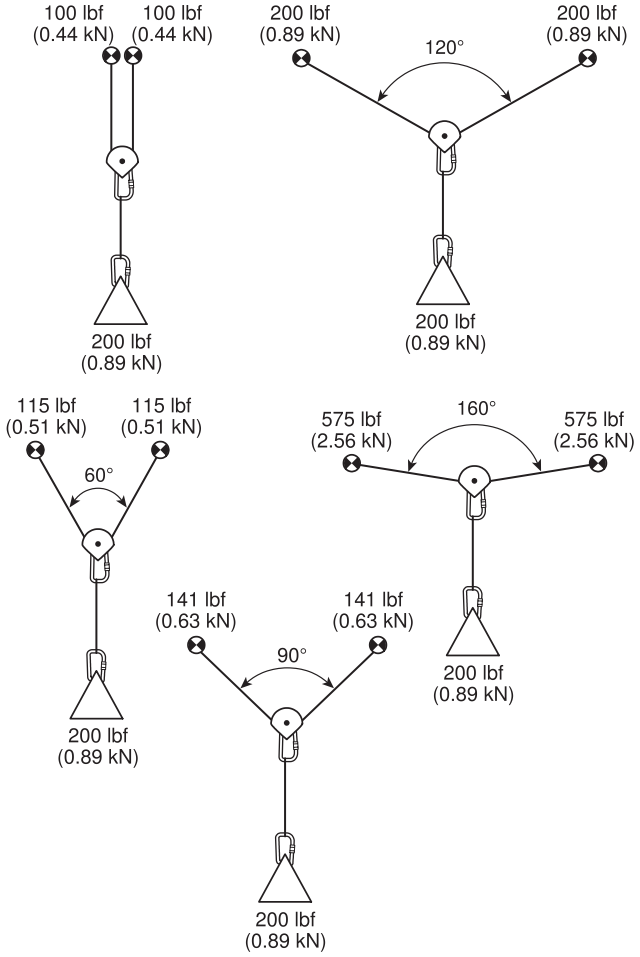


FIGURE A.3.3.44 Two-Point Anchor Systems Showing Relative Force.

A.3.3.45 Decontamination. Decontamination is specific to the removal or neutralization of contamination whereas cleaning can remove both soiling and contamination. Decontamination might also apply to certain types of specialized cleaning where particular procedures are used to remove or neutralize contaminants other than products of combustion that are found on protective ensembles or elements.

Decontamination might involve mechanical, chemical, thermal, or combined processes for removing or neutralizing contaminants. An example of a mechanical process is where brushing or wiping removes an exterior contaminant from the surface of the element. Chemical processes involve the use of detergents or other cleaning agents that react with or aid in the removal of contaminants from element materials. Heating is one type of a thermal process where higher temperatures could cause certain contaminants to evaporate out of the element materials. Laundering is a form of a combined process where the machine agitation, use of a detergent, and heated water all work together to remove contaminants from the element.

A.3.3.49.2 Ascending Device. Ascent devices for ascending a fixed line are often also referred to as ascenders. These devices are considered part of the larger family group of rope grab devices. Ascenders are most often used in technical use ascent systems although most rope grabs including general use ones can also be used as an ascender.

A.3.3.49.5 Escape Anchor Device. A carabiner that does not connect to the structure but aids in tying an escape line to the structure is not considered an escape anchor device. The escape anchor device section applies to components intended to be attached to the end of an escape line and used to quickly attach the rope to a suitable anchor. It is not intended to apply to a snap-link or carabiner used with or attached to an escape line.

A.3.3.58.1 90 Percent Diver. The intent is for this diver to be fully dressed, with the possible exception of fins and facemask, all safety checks performed, and all necessary equipment is on hand to perform the intended mission. The 90 percent diver can be in the water, on the shore, or in a vessel at the entry point.

A.3.3.58.2 Safety Diver. The intent is that this diver is positioned in such a manner that he or she can be deployed to the location of the submerged diver(s) as quickly as possible. This often requires the safety diver to be in the water with all equipment, including facemask, donned and safety checked, neutral buoyancy established, and immediately ready to submerge at the signal to deploy. The diver should be briefed in advance of potential dive-related hazards and the action required in response. In some cases, the diver might need to be aboard a vessel or on the shore.

A.3.3.66 Entry Permit. An entry permit authorizes specific employees to enter a confined space and contains specific information as required.

In certain industries, U.S. federal law does not require a permit system even though spaces meeting the characteristics of confined spaces as defined within this standard might be present. In these cases, as well as cases of unauthorized or nonregulated entry into confined spaces, a permit might not be available for reference by the rescue team. The space must be completely assessed before entry can be safely made. U.S. federal law does not require rescuers to have a permit to rescue, although it is advisable for the rescue team to follow similar procedures to ensure safety.

A.3.3.68 Environment. Examples include desert, alpine/mountain, arctic, rain forest, and seashore.

A.3.3.80 Fall Factor. Fall factors (see Figure A.3.3.80) are calculated by dividing the distance the person attached to the rope will fall by the length of the rope between the person and the rope anchor or belay. Thus, a 305 mm (1 ft) fall on a 150 mm (½ ft) rope would be a fall factor of 2.0; a 305 mm (1 ft) fall on a 305 mm (1 ft) rope would be a 1.0 fall factor; a 305 mm (1 ft) fall on a 1.12 m (4 ft) rope would be a 0.25 fall factor; and a 305 mm (1 ft) fall on a 12.2 m (40 ft) rope would be a 0.025 fall factor. Note as well that a 7.6 m (25 ft) fall on a 30.5 m (100 ft) rope is also a 0.25 fall factor. This formula assumes the fall takes place in free air without rope drag across building edges or through intermediate equipment.

When fall factors of greater than 0.25 are anticipated, such as are possible in lead climbing, dynamic ropes specifically designed for climbing should be considered. Only ropes certified to appropriate climbing rope standards [e.g., the International Mountaineering and Climbing Federation (UIAA) and European Community (CE)] are appropriate for this use. Dynamic climbing ropes should be stored, maintained, inspected, and use-logged in a manner similar to that required for static/low-stretch rope. Such operations are outside the scope of this document. A fall factor of 0.25 is the maximum considered for NFPA 1983.

Research indicates that the "fall factor" method of estimating the effects of a fall on an anchor or a load does not translate equally between dynamic ropes and the static and low-stretch type ropes used for fire service rescue operations. Other methods of force calculation can be used as needed.

A.3.3.81 FEMA Task Force Structure/Hazard Evaluation Marking System. Markings are made by drawing a 2 ft × 2 ft (0.6 m × 0.6 m) square box and denoting in and around the box specific relevant hazard information (e.g., general level of operation safety, direction of safest entry, time and date of search, hazards found, team involved). Figure F.3(a) illustrates the structure/hazard evaluation marking system. For more information, see "FEMA National Urban Search and Rescue (US&R) Response System."

A.3.3.82 FEMA Task Force Structure Marking System, Structure Identification Within a Geographic Area. The primary method of identification includes the existing street name, hundred block, and building number. Structure identification within a geographic area is used to differentiate buildings by groups, such as by block(s) or by jurisdictional area. Figure F.4(a) illustrates the building ID and location marking system. For more information see "FEMA National Urban Search and Rescue (US&R) Response System," Appendix C, "Task Force Building Marking System."

A.3.3.91 General Area. The general area is sometimes referred to as the "warm zone" and is usually the area 300 ft (90 m) in all directions from the incident site.

A.3.3.92 General Use. Rescue personnel may elect to use either technical or general use labeled equipment based on anticipated loads and acceptable safety margins as established by the authority having jurisdiction (AHJ). This choice should be based on the levels of operational capability of the organization. The AHJ should compile and evaluate information on the

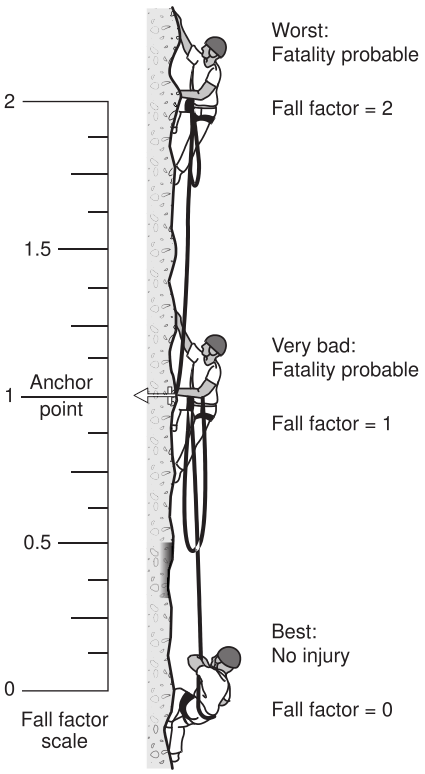


FIGURE A.3.3.80 Fall Factors.

comparative advantages and disadvantages of the rope and equipment under consideration. For example, an organization at the operational level performing simple rescues might require the higher margin of safety offered by general use equipment. The highly trained or specialized organization performing the more complicated rescue might benefit from the lighter weight of technical use equipment, but due to their level of training can maintain an acceptable level of safety and efficiency for the specified operation.

A.3.3.93 Hand. While a soft hand makes knots in ropes easier to tie, they might not untie after loading as easily if the hand is too soft. Ropes with a soft hand can also overly flatten out over edges and when running through descent control devices and pulleys.

Ropes with a very stiff hand have better abrasion resistance and flatten less in devices, and loaded knots might be easier to untie. The correct choice could be between these extremes, depending on the devices being used with the rope and the environment in which it will be rigged.

A.3.3.109 Incident Scene. The incident scene includes the entire area subject to incident-related hazards and all areas used by incident personnel and equipment in proximity to the incident.

A.3.3.110 Isolation System. Examples of isolation devices include concrete or steel pipe, corrugated pipe, concrete vaults, and other pre-engineered structures that sufficiently isolate and protect the victim.

A.3.3.111 Knot. Knots, bends, and hitches represent the three types of ties used to bind ropes and webbing. However, the term knot is sometimes used generically to refer to all types of rope or webbing ties.

A.3.3.113 Large Animal. It should be noted that the skill sets within this document can be applied to exotic/wild large animals such as tigers, antelope, bears, rhinos, and so forth with appropriate chemical restraint administered by an appropriate person as defined by the AHJ.

A.3.3.121.1 Design Load. The design load used in developing the minimum performance requirement of a component to this standard is applicable only when the forces are applied to the component in a direct, linear fashion. The loads placed on a component through rigging and creation of a system can be increased due to the vectors used in the rigging. Loads can be amplified substantially when forces are applied in differing directions. Users should develop processes to identify loads placed on each component when creating systems and to determine whether or not they are acceptable. For example, a rope used in a highline system as the main line could be loaded (tensioned) with more than 10 times the actual load being carried across on the highline system depending on the angles involved in the rigging of the highline system.

Design loads are used as reference loads for testing of products. This does not constitute any endorsement on behalf of NFPA that a product cannot or should not exceed this load. The designation of a 1-person or 2-person load was removed from the standard due to the misconception that items were not to exceed a 1-person or 2-two person load, depending on the items designation. Some items are tested with a 1.33 kN (300 lb) or a 2.67 kN (600 lb) load, but the test method results in forces being generated that far exceed the base load. The AHJ must determine the equipment capability based on manufacturer information, the intended use of the product, and the team capability in load or force calculations.

A.3.3.121.2 Impact Load. For the purposes of this document, fall factors greater than 0.25 generate unacceptable impact loads.

A.3.3.121.3 Proof Load. The applied proof load is usually well above the allowable service load, but low enough so as not to damage the product being tested.

A.3.3.124 Lockout. Usually a disconnect switch, circuit breaker, valve, or other energy-isolating mechanism is used to hold equipment in a safe position. It can include the use of guards when other mechanisms are not available. However, the use of guards can violate federal lockout/tagout regulations in federally regulated facilities. Lockout is usually performed in combination with a tagout procedure.

A.3.3.127 Lowering System. Lowering systems should incorporate a mechanism to prevent the uncontrolled descent of the load during the lowering operation. This mechanism can reduce the need for excessive physical force to control the lowering operation.

A.3.3.132 Manufacturer-Supplied Eye Termination. For example, sewn or swaged eyes provided in the end of a rope or line by the manufacturer of a compliant rope component or system.

A.3.3.136 Mechanical Advantage (M/A). For example, a rope mechanical advantage system that requires only 10 lb (4.54 kg) of input force to produce 30 lb (13.6 kg) of output force has a 3:1 mechanical advantage [301 lbf (13.61 kgf), or 3:1]. Likewise, a system that requires 30 lb (13.6 kg) of input force to

produce 30 lb (13.6 kg) of output force has a 1:1 mechanical advantage. There is no such thing as zero mechanical advantage. Other factors can affect the efficiency of a mechanical advantage system, including friction and drag created by the equipment. For purposes of this document, these factors are not considered and so the mechanical advantage is theoretical rather than actual. Rope-based mechanical advantage systems are generally classified as simple, compound or complex.

A.3.3.140 Minimum Primary Reserve Pressure. For the purposes of this document, minimum primary reserve pressure is one third of the entire rated capacity of breathing gas available to the diver. In no case should the established minimum reserve pressure for the primary source of breathing gas be less than 500 psi.

Dive operations involve work in an IDLH environment. To ensure safe dive operations, all divers must plan their dives to maintain an adequate reserve to manage unforeseen circumstances.

The one-third reserve should be calculated in advance for specific sizes of the cylinders used by the team by using the total volume of air, including any redundant air systems, adjusted for the rated working pressure of the cylinders associated with the breathing gas systems. From that calculation, determine the primary system pressure that would leave the diver with approximately one third the total volume in reserve. It is not the intent to calculate the reserve pressure based on the actual pressure of the cylinder at the start of the dive but always with the rated working pressure of the cylinder.

A diver equipped with only a standard aluminum cylinder 80 gets 80 ft^3 (2.27 m^3) at 3000 psi. Because there is no redundant air supply (RAS), the entire reserve one-third volume of 26.6 ft^3 (0.74 m^3) must be carried in the primary system.

(26.6 ft^3 × 3000 psi)/80 ft^3 = 1000 psi

A diver equipped with an 80 ft^3 primary HP Steel and Pony cylinder with a working pressure of 3500 psi and 21 ft^3 (0.59 m^3) redundant air system cylinder has a total of 101 ft^3 (2.86 m^3). The diver needs to be on the surface with approximately 33.6 ft^3 (0.93 m^3) to meet the one third. Subtract the 21 ft^3 (0.59 m^3) provided in the RAS cylinder to leave 12.6 ft^3 (0.34 m^3) in the primary for the required reserve.

(12.6 ft^3 × 3500 psi)/80 ft^3 = 472 psi

Even though the calculated minimum surface reserve pressure is 472 lb (214 kg), the minimum permissible breathing gas pressure is 500 psi. In this case the diver's minimum primary reserve pressure is 500 psi.

Ensuring that divers comply with the required minimum reserve pressure is often a challenge to agencies that perform public safety diving. Ensuring that divers get adequate training using the established limits, including calculating additional air required to perform the ascent and relevant safety stops, is a key element to ensuring compliance. Training should be conducted at depths and under conditions that simulate an actual rescue environment while performing mission-specific work as often as possible so that divers can set proper expectations about air consumption and exertion levels. Instances where divers violate the minimum reserve pressure should be treated as a breach of policy, and the contributing factors should be documented to prevent recurrence. The AHJ is responsible for holding divers and supervisors accountable for compliance with established limits.

A.3.3.142 Multiple Configuration Load Straps. These can be, but are not limited to, anchor straps and rigging straps.

A.3.3.143 Multiple-Point Anchor System. The subcategories of this type of system can be further defined as follows:

(1) Load-distributing anchor systems (also referred to as self-equalizing or self-adjusting) are anchor systems established from two or more anchor points that meet the following criteria:
   (a) They maintain near-equal loading on the anchor points despite direction changes on the main line rope.
   (b) They re-establish equal loading on remaining anchor points if any one of them fails. The system should be configured so as to limit the resulting drop that occurs as the result of an anchor point failure.

(2) Load-sharing anchor systems are established from two or more anchor points that distribute the load among the anchor points somewhat proportionately but will not adjust the direction changes on the main line rope. The system should be configured so as to limit the resulting drop that occurs as the result of an anchor point failure.

A.3.3.144 National Response Framework. The National Response Framework replaces the National Response Plan (NRP) and is available at http://www.fema.gov/emergency/nrf/. In recent years, the United States has faced an unprecedented series of disasters and emergencies, and as a result U.S. response structures have evolved and improved to meet such threats. This framework represents a natural evolution of the national response architecture. Although the NRP was called a plan, it was actually a framework written to guide the integration of community, state, tribal, and federal response efforts. Adopting the term *framework* within the title now aligns the document with its purpose. The purpose of the National Response Framework is to establish a comprehensive, national, all-hazards approach to domestic incident response. The framework is written for senior elected and appointed leaders, such as federal agency heads, state governors, tribal leaders, and mayors or city managers — those who have a responsibility to provide for effective incident management. At the same time, it informs emergency management practitioners, explaining the operating structures and tools used routinely by first responders and emergency managers at all levels of government.

A.3.3.145 National Search and Rescue Plan. According to this plan, all maritime or navigable water search and rescue (SAR) is the responsibility of the U.S. Coast Guard, and all inland SAR is the responsibility of the U.S. Air Force.

A.3.3.153 Personal Protective Equipment (PPE). PPE includes protective apparel (e.g., clothing, footwear, gloves, and headgear) as well as personal protective devices (e.g., goggles, face shields, hearing protectors, and respirators). Adequate PPE should protect the respiratory system, skin, eyes, face, hands, feet, body, and ears.

A.3.3.155 Portable Anchor. Examples include but are not limited to davits, A-frames, tripods, quadpods, and cantilever devices.

A.3.3.160 Primary Search. In a structural collapse situation, a primary search is a relatively fast-paced scan of the surface of

debris and selected void spaces in and around structures that can be accomplished simultaneously with a reconnaissance operation. The size and makeup of a team established for primary search purposes should be incident-driven and flexible and can include physical, canine, and technical search resources. During this type of operation, victim locations are marked and reported, and appropriate resources are called in to further locate and/or extricate victims while the primary search continues.

A.3.3.161 Product Label. This product label is not a certification organization's label, symbol, or identifying mark; however, the certification organization's label, symbol, or identifying mark can be attached to it or be part of it.

A.3.3.164 Protective System. Protective systems include support systems, sloping and benching systems, shield systems, and other systems that provide the necessary protection.

A.3.3.167 Raising System. Raising systems should incorporate a mechanical means to prevent the load from falling should the primary control mechanism be released during the raising operation.

A.3.3.169 Reconnaissance (Recon). A recon operation is not a search. It is a fast visual check of an entire area with the intention of obtaining information about the area. During a recon operation, no SAR tactics are performed. The size and makeup of a team established for recon purposes should be incident-driven and flexible and can be deployed on land, in or on water, or by air.

A.3.3.171 Redundant Air System. This breathing gas system is typically configured with a "pony" cylinder connected to a first- and second-stage regulator, which is then attached to the buoyancy compensator or strapped to the primary cylinder. It is intended to provide a source of air that is independent from any failure in the primary delivery system; as such it is not typically intended to be connected to the primary system by a block or other device unless one of the following occurs:

(1) The device is constructed with a feature that prevents the contents of the reserve cylinder from free flowing out a breach in the primary delivery system, such as a full facemask (FFM).
(2) The device is in addition to a conventional second stage.

A.3.3.172 Registered Professional Engineer. A registered professional engineer registered in any state is deemed to be a "registered professional engineer" within the meaning of this standard when approving designs for manufactured protective systems or tabulated data to be used in the construction of protective systems.

A.3.3.174 Rescue Area. Sometimes rescue area is generally defined as an area 50 ft (15 m) in all directions from the incident site, or a distance in all directions equal to the height of the structure involved in the collapse plus a third.

A.3.3.179 Rescue Team. The number of persons required for an effective team is dependent upon variables such as the task(s) to be completed, the abilities of the individual team members, and the individuals' ability to work together efficiently. Although many recommendations exist as to an "ideal" minimum number of team members, this should be based on the circumstances surrounding the incident and the logistics involved.

A.3.3.182 Retrieval System. In U.S. federally regulated industrial facilities, these systems are required whenever an authorized entrant enters a confined space unless the retrieval system would increase the overall risk of entry or would not contribute to the rescue of the entrant. For confined space rescue operations, these systems should be in place prior to entry (into vertical or horizontal spaces) in such a manner that retrieval of rescue entrants can begin immediately in the event of an emergency. Retrieval systems can also be used to act as fall-arresting devices for rescue personnel.

A.3.3.185 Risk/Benefit Analysis. Traditionally in search and rescue, this analysis involves the assessment of the general status of the victim(s) in order to apply the proper urgency to the situation (rescue versus body recovery). A live victim suggests a rescue and its associated high level of urgency. A deceased victim, however, requires a body recovery, which suggests a far less urgent response.

A.3.3.186.1 Block Creel Construction. Unavoidable knots could be present in individual fibers as received from the fiber producer.

A.3.3.186.4 Life Safety Rope. The term *life safety rope* generally refers to any rope that is used specifically for the purpose of suspending or protecting human life. Only rope that is specifically designated and intended by the manufacturer for such use should be used to protect human life. Within the context of NFPA 1983 and NFPA 1858, certain specialty rope types exist within the broader classification of life safety rope, such as escape rope, fire escape rope, and moderate elongation laid life-saving rope. Where circumstances dictate, these specialty ropes should be specified and used. For rescue, safety, and other various non-specific uses, and where specialty rope is not necessarily called for, use of ropes meeting the broader classification of life safety rope is generally acceptable.

A.3.3.194 Secondary Search. See A.3.3.42, Coverage.

A.3.3.197 Shield (or Shield System). Shields can be permanent structures that are designed to be portable and moved along. Shields can be either manufactured or job-built in accordance with 29 CFR 1926.652 (c)(3) or (c)(4). Shields used in trenches are usually referred to as "trench boxes" or "trench shields."

A.3.3.204 Soiling. Soiling excludes contaminants that could adversely affect the wearer such as products of combustion and other hazardous materials, including toxic, corrosive, or sensitizing chemicals, potentially infectious body fluids, other infectious microorganisms, and CBRN terrorism agents. Since many fireground exposures with entry into a structure will involve exposure to combustion products that contain hazardous chemicals and other substances including carcinogens, any exposure to these conditions could result in contamination.

A.3.3.207 Standard Deviation. In this standard, standard deviation is calculated using the formulas in 28.2.5.2.

A.3.3.210 Strongback. Uprights placed so that the individual members are closely spaced, in contact with, or interconnected to each other are considered "sheeting."

A.3.3.212 Supplemental Sheeting and Shoring. Supplemental sheeting and shoring requires additional training beyond that of traditional sheeting and shoring.

A.3.3.216 System Safety Factor. Determining the system safety factor requires the evaluation of the strength of the components within the system, how their configuration reduces their strength, and the effects of force multipliers. The system strength is determined by first evaluating the strength of all parts of the system. This is then compared to the expected force applied, which is expressed as a ratio. The lowest ratio found in the system is the weakest link and, therefore, the system safety factor.

Examples of configurations that decrease the strength of components include, but are not limited to, the following:

(1) Knots in the rope
(2) Ropes traversing sharp edges
(3) Cross-loaded carabiners
(4) Pulleys used to change direction
(5) Environmental concerns, in particular water
(6) Angles between components that increase the forces on the components or the anchors
(7) Vector forces on ropes tensioned at both ends such as high-lines

A.3.3.218 Tabulated Data. The term is also applied to six tables found in Appendix C of 29 CFR 1926, Subpart P.

A.3.3.221 Technical Search and Rescue Incident. Technical rescue incidents can include water rescue, rope rescue, confined space rescue, wilderness search and rescue, trench rescue, vehicle and machinery rescue, dive search and rescue, collapse rescue, and other rescue operations requiring specialized training.

A.3.3.222 Technical Use. Rescue personnel can elect to use either technical or general use labeled equipment based on anticipated loads and acceptable safety margins as established by the authority having jurisdiction (AHJ). This choice should be based on the levels of operational capability of the organization. The AHJ should compile and evaluate information on the comparative advantages and disadvantages of the rope and equipment under consideration. For example, an organization at the operational level performing simple rescues might require the higher margin of safety offered by general use equipment. The highly trained or specialized organization performing the more complicated rescue might benefit from the lighter weight of technical use equipment, but due to their level of training can maintain an acceptable level of safety and efficiency for the specified operation.

A.3.3.224 Terrain. Examples include cliffs, steep slopes, rivers, streams, valleys, fields, mountainsides, and beaches.

A.3.3.225 Terrain Hazard. Examples include cliffs, caves, wells, mines, avalanches, and rock slides.

A.3.3.228 Traditional Sheeting and Shoring. Some newer-style sheeting and shoring might not require a strongback attachment (refer to manufacturer recommendations).

A.3.3.230 Trench (or Trench Excavation). In general, the depth is greater than the width, but the width of a trench (measured at the bottom) is no greater than 15 ft (4.6 m). If forms or other structures are installed or constructed in an excavation so as to reduce the dimension measured from the forms or structure to the side of the excavation to 15 ft (4.6 m) (or less, the excavation is also considered a trench.

A.3.3.232 Tunnel. The health and safety regulations regarding the construction of tunnels apply to all excavations that are, or will be, connected to the tunnel, including shafts and trenches.

A.3.3.233 Universal Precautions. Under circumstances in which differentiation between body fluids is difficult or impossible, all body fluids should be considered potentially infectious materials.

A.3.3.240 Wilderness. The wilderness often includes a collection of various environments such as forests, mountains, deserts, natural parks, animal refuges, rain forests, and so forth. Depending on terrain and environmental factors, the wilderness can be as little as a few minutes into the backcountry or less than a few feet off the roadway. Incidents with only a short access time could require an extended evacuation and thus qualify as a wilderness incident. Extreme weather or other disasters can cause urban areas to share many characteristics with the wilderness.

Situational and incident examples are the Space Shuttle Columbia recovery, Katrina flood areas, law enforcement tactical unit operations, terrorist-type events, hurricanes, earthquakes, and other disasters.

Note that item (3) in the definition is not referring to the environmental definition of wilderness as a roadless area, but as a wild environment.

A.4.1.1.1 Chapters 4 through 23 were developed to define levels of preparation and operational capability that should be achieved by any authority having jurisdiction (AHJ) that has responsibility for technical rescue operations. These defined levels provide an outline of a system used to manage an incident efficiently and effectively, to maximize personnel safety, and to bring about the successful rescue of victims and the eventual termination of the event. The system should be followed to increase the capabilities of the AHJ to deal successfully with even the most complex incident. The system progresses from the simple basic awareness level to the operations level, and, finally, to the technician level. It should be understood that, as the system expands, the requirements for training, operational skills, management ability, and types and amounts of equipment also expand.

A.4.1.1.2 Organizations providing such rescue, fire suppression, and emergency services can include fire departments, law enforcement, emergency medical services, and utility, public works, and rescue organizations.

A.4.1.1.3 While organizations can meet the requirements of Chapters 4 through 23, individuals and their skills and qualifications are outside of the scope of this document and are addressed in NFPA 1006.

A.4.1.2 An organization can achieve its desired level of operational capability through the use of external resources that operate at that desired level.

A.4.2.1 Safe operations at technical rescue incidents should include the assessment and acquisition of external resources required for situations beyond the operational capability of the organization. For example, a situation in a confined space or trench might require a technician-level hazardous materials response capability.

A.4.2.1.1 It is recognized that many technical rescue incidents require a combination of disciplines. Where these are anticipated and identified, an organization should be capable of performing these combinations. For example, a vehicular accident involving travel down an embankment, ending in water submersion, might require elements of rope, swiftwater, and vehicular rescue. It is important for organizations to recognize the potential for these technical rescue combinations where they appear likely based on their jurisdictional survey.

A.4.2.1.2 There are obvious technical rescue combinations that should be considered by the AHJ. Examples of these combinations could include, but are not limited to, the following:

(1) Flood rescue with swiftwater rescue
(2) Confined space rescue with rope rescue
(3) Swiftwater rescue with rope rescue
(4) Swiftwater rescue with vehicular rescue
(5) Tower rescue with rope rescue

It is imperative that organizations analyze their most likely scenarios to ensure appropriate provisions.

A.4.2.3 Responding organizations should focus their resources on the types of incidents and levels of response that are most appropriate for their response area. In many cases, it is better to rely on another responding organization for a given type of response when the number of incidents responded to in that discipline does not support the time and expense of maintaining the necessary level of proficiency.

A.4.2.4(1) This level can involve search, rescue, and recovery activities. Members of a team at this level are generally not considered rescuers.

A.4.2.4(2) This level can involve search, rescue, and recovery activities, which are usually carried out under the supervision of technician-level personnel.

A.4.2.6 A technician is a person who knows the subject matter thoroughly or knows where to get the answer quickly. He or she also can think through problems that have never (or rarely) been seen before and is comfortable in that environment. This ability might have been achieved through experience, including numerous operations in that discipline and/or through extensive, repetitive training in realistic scenarios of that discipline.

A.4.2.10 While certification at the EMT level is the minimum level of medical care required, certification at the advanced EMT (AEMT) or paramedic level is recommended. The AHJ should consider the development of an advanced capability in medical response to reflect the needs of the technical rescue environment.

A.4.2.11.1.3 It is important to note that this requirement, unless specifically designated within a particular discipline, does not prohibit an organization from operating with combinations of personnel with varying competency levels as long as the operational capability of the organization is met. For example, a technician-level rope rescue involving a highline operation could require some team members to apply technician-level skills while others might require only operations-level individual skills. Not all members of the organization would be required to meet NFPA 1006 technician-level rope rescue certification.

A.4.2.11.2 Organizations should provide ongoing training commensurate with proficiency to the identified operational level of capability in each applicable technical search and rescue discipline. The amount and frequency of this continuing education required is commonly based on criteria such as the current competency and aptitude of the team, fiscal constraints, and time constraints. However, this standard provides that the AHJ utilize performance-based evaluation as the primary basis for the amount and frequency of training required to meet this standard. Organizations demonstrating poor performance during evaluation imply a need for a greater amount and/or frequency of training.

A.4.2.11.4 In all types of search and rescue incidents, the potential exists for extenuating circumstances that would require expertise beyond the normal capability of the organization to operate safely. Examples of these situations include, but are not limited to, the following:

(1) *Structural Collapse.* Multiple collapse sites, large number of victims, numerous deeply buried victims, multiple complications (e.g., both deeply buried victims and multiple sites), involvement of hazardous/toxic substances, or severe environmental conditions (e.g., snow and rain)
(2) *Rope Rescue.* Lowering and raising operations requiring significant obstacle negotiation, descending or ascending operations from extreme heights, or severe environmental conditions (e.g., snow and rain)
(3) *Confined Space Search and Rescue.* Deep or isolated spaces, multiple complicating hazards (e.g., water, chemicals, and extreme height in a space), failure of essential equipment, or severe environmental conditions (e.g., snow and rain)
(4) *Vehicle and Machinery Search and Rescue.* Complex and/or unusual machinery, unusual vehicles, unusual locations of either machinery or vehicles, multiple complicating hazards (e.g., water, chemicals, and extreme height), failure of essential equipment, or severe environmental conditions (e.g., snow and rain)
(5) *Water Search and Rescue.* Depth, current, water movement, water temperature extremes, or severe environmental conditions (e.g., snow and rain)
(6) *Wilderness Search and Rescue.* Isolated and remote environments and extremes of environmental conditions (e.g., snow, rain, altitude)
(7) *Trench and Excavation Search and Rescue.* Very deep trenches, unusually shaped excavations, multiple complications (e.g., deep excavation and fluid soil), involvement of hazardous/toxic substances, completely buried subjects, or severe environmental conditions (e.g., snow and rain)

These conditions should be evaluated during the pre-incident risk assessment and on an incident-by-incident basis.

A.4.2.11.5 This documentation should contain each recipient's name, the signatures or initials of the trainers, the dates of training, an outline of the training conducted, and resource materials used to develop the training.

A.4.2.14 Legal considerations have an impact on many phases of a technical rescue incident (e.g., confined space regulations, use/maintenance of SCBA, right-of-entry laws during a search, right-to-privacy laws during an investigation). Whatever the capacity in which a rescuer functions (public or private), it is important that the rescuer be informed regarding all relevant legal restrictions, requirements, obligations, standards, and

duties. Failure to do so could jeopardize the reliability of any investigation or operation and could subject the rescuer to civil liability or criminal prosecution.

A.4.2.15 Personnel involved in search and rescue (SAR) in the United States, and in other countries that have adopted its use, should also familiarize themselves with the *International Aeronautical and Maritime Search and Rescue (IAMSAR) Manual* and the *United States National Search and Rescue Supplement* (NSS) *to the IAMSAR* (soon to be renamed the *National SAR Manual*).

The *IAMSAR Manual* is a three-volume set of reference materials jointly published by the International Civil Aviation Organization (ICAO) and the International Maritime Organization (IMO). It was intended for use by all countries and provides implementation guidance for the *National Search and Rescue Plan for the United States* (2007).

The NSS, prepared under the direction of the National Search and Rescue Committee (NSARC), provides guidance to federal agencies concerning implementation of the National Search and Rescue Plan. The NSS provides specific additional national standards and guidance that build upon the baseline established in the *IAMSAR Manual* and provides guidance to all federal forces, military and civilian, that support civil search and rescue operations.

A.4.3.1 A hazard identification and risk assessment is an evaluation and analysis of the environment and physical factors influencing the scope, frequency, and magnitude of technical rescue incidents and the impact and influence they can have on the ability of the AHJ to respond to and safely operate at these incidents.

The goal and terminal objectives of the hazard identification and risk assessment are to increase the awareness of the AHJ and to provide a focus toward conditions and factors associated with potential technical rescue responses.

The hazard identification and risk assessment can be associated closely with similar functional and format methodology, as might be incorporated in a master plan or strategic deployment study. It is not the intent of this standard to encumber the AHJ in its undertaking of a detailed and extensive analysis of each technical rescue environment within the jurisdiction; rather, this standard is meant to provide means for a deliberate and objective examination of common or unique factors that can be identified, correlated, or highlighted to aid in the development of technical rescue capabilities and to determine their necessary level of expertise to provide risk reduction.

The hazard identification and risk assessment determines "what" can occur, "when" (how often) it is likely to occur, and "how bad" the effects could be. For certain of the hazards identified, it will be determined after this preliminary analysis that it is not necessary to carry out a full analysis. For such hazards, no further action is required.

The hazard identification should include, but not be limited to, the following types of potential hazards:

(1) Natural events
    (a) Drought
    (b) Fire (forest, range, urban)
    (c) Avalanche
    (d) Snow/ice/hail
    (e) Tsunami
    (f) Windstorm/tropical storm
    (g) Hurricane/typhoon/cyclone
    (h) Biological
    (i) Extreme heat/cold
    (j) Flood/wind-driven water
    (k) Earthquake/land shift
    (l) Volcanic eruption
    (m) Tornado
    (n) Landslide/mudslide
    (o) Dust/sand storm
    (p) Lightning storm
(2) Technological events
    (a) Hazardous material release
    (b) Explosion/fire
    (c) Transportation accident
    (d) Building/structure collapse
    (e) Power/utility failure
    (f) Extreme air pollution
    (g) Radiological accident
    (h) Dam/levee failure
    (i) Fuel/resource shortage
    (j) Business interruption
    (k) Financial collapse
    (l) Communication
(3) Human events
    (a) Economic
    (b) General strike
    (c) Terrorism (eco, cyber, nuclear, biological, and chemical)
    (d) Sabotage
    (e) Hostage situation(s)
    (f) Civil unrest
    (g) Enemy attack
    (h) Arson
    (i) Community-wide panic
    (j) Special events

There are a number of methodologies and techniques for risk assessment that range from simple to complex. These techniques include, but are not limited to, the following:

(1) What-if
(2) Checklist
(3) Hazop, hazard, and operability studies
(4) Failure modes and effect analysis
(5) Fault tree
(6) Failure-logic diagrams
(7) Dow and bond indices
(8) Event tree analysis
(9) Human reliability analysis
(10) Capability assessment readiness for state and local governments

A.4.3.3 As part of the risk assessment, the AHJ should identify the types of internal resources immediately available, within the operational structure of the organization, that could be utilized for technical search and rescue incident response. The resource list should include the availability of personnel, training levels of personnel, professional specialty or trade skills, and type, quantity, and location of equipment, appliances, and tools applicable to technical search and rescue incident response.

A.4.3.4 See Annex D.

A.4.3.5 The intent of this provision is to establish procedures to enable the incident commander to obtain the necessary

resources to augment the internal capabilities of the AHJ. These resources can include, but are not limited to, the following:

(1) Mutual aid agreements
(2) Agreements with the private sector, including the following:
    (a) Organizations specializing in the specific skills and/or equipment required to resolve the incident
    (b) Special equipment supply companies
    (c) Related technical specialists
    (d) Communications
    (e) Food service
    (f) Sanitation
(3) Memorandums of Agreement (MOA) with other public, state, or federal agencies

A.4.5.1.1 Specific specialized equipment that might be required for safe technical rescue operations includes the following:

(1) Supplied line breathing apparatus (SLBA), supplied air breathing apparatus (SABA), and supplied air respirator (SAR), all of which should meet the requirements of 29 CFR 1910.146, "Permit-Required Confined Spaces"
(2) Personal alert safety system (PASS), which should meet the requirements of NFPA 1500 and NFPA 1982
(3) Life safety ropes and system components, which should meet the requirements of NFPA 1500 and the applicable requirements of NFPA 2500
(4) Communications equipment, which should meet the requirements of 29 CFR 1910.146
(5) Lighting equipment (e.g., flashlights, helmet-mounted lamps), which should be, depending on the situation, intrinsically safe or explosion proof as defined by 29 CFR 1910.146, and should be evaluated by the AHJ as to the appropriateness of the equipment at an emergency incident with regard to the existing hazards

A.4.5.2.1 Protective equipment should be appropriate to the tasks that are expected to be performed during technical search and rescue incidents and training exercises.

A.4.6.1.4 BLS is the minimum level required; advanced life support (ALS) is recommended.

A.4.6.1.5 Interagency cooperation is essential to the successful mitigation of many technical rescue incidents. Personnel from fire, rescue, emergency medical services (EMS), and law enforcement can be involved in an operation at all levels, from recognition through command. It is recommended that all agencies involved in rescue review and/or develop policies regarding control of firearms. The complete exclusion of firearms might not always be practical and/or feasible on the incident scene but is generally recommended.

A.4.6.3.1 The incident management system (IMS) utilized at all technical search and rescue incidents should be structured to address the unique groups, divisions, or branches that can be necessary to effectively manage the specific type of incident (e.g., structural collapse, trench/excavation cave-in). Managing external influences such as family, news media, and political entities involves instructing subordinates in how to deal with them should they be encountered. NFPA 1561 in 5.9.4.5, describes the use of an information officer (a member of the command staff) to address these types of influences. Where encounters with family, news media, or political influences are likely, such a function should be filled as soon as possible.

A.4.6.4 The AHJ should address the possibility of members of the organization having physical and/or psychological disorders (e.g., physical disabilities, fear of heights, fear of enclosed spaces) that can impair their ability to perform search and rescue in a specific environment.

Organizations are encouraged to adopt language similar to that included in Chapter 11, Medical and Physical Requirements, of NFPA 1500 regarding their medical and physical requirements.

A.4.6.5.1 These incidents can be caused by natural, accidental, or intentional means.

A.5.1.2 While rope rescues by themselves do not generally involve searches, it is appropriate for the AHJ to consider the environment in which rope rescues might occur and to assess the relative need. For example, high- and low-angle incidents occurring within certain environments can involve a significant search component (such as wilderness or structural collapse covered in other chapters of this document). Once located, the victim might then require the capabilities of rope rescue stated within Chapter 5.

A.5.1.3 It is important that organizations training rope rescue teams recognize the significance of, not only having a team perform the techniques required, but also assuring they are able to do so within a time frame and manner that would provide the best profile for successful rescue. The elements of timeliness and efficiency are paramount to assure this success. For example, a team that is required to construct and operate a rescue system will not benefit themselves or the victim unless they are required to do so quickly enough that the victim, under usual circumstances, would still be considered viable. Organizations should establish measurable standards for completion of required techniques within a given time frame based on the response conditions and nature of the anticipated emergency.

A.5.2.2(2) The intent of this provision is to establish procedures to enable the incident commander to obtain the necessary resources to augment the internal capabilities of the AHJ. These resources can include, but are not limited to, the following:

(1) Mutual aid agreements
(2) Agreements with the private sector, including the following:
    (a) Construction industry
    (b) Demolition industry
    (c) Heavy equipment operators
    (d) Special equipment supply companies
    (e) Hardware, lumber, and construction suppliers
    (f) Consulting engineers and architects
    (g) Related technical specialists
    (h) Communications
    (i) Food service
    (j) Sanitation
(3) Memorandums of Agreement (MOA) with other public, state, or federal agencies

A.5.2.2(3) The emergency response system includes, but is not limited to, operations- and technician-level personnel capable of responding, as well as local, state, and national resources.

A.5.2.2(4) These procedures should include the process of achieving and maintaining control of the site and the perimeter. This process might include management of all civilian and nonemergency personnel and establishment of operational zones and site security.

A.5.2.2(5) General hazards associated with rope rescue operations can present the AHJ with uniquely challenging situations. The AHJ should consider the following potential hazards when providing training to its members:

(1) *Fall Hazards.* Rope rescue incidents are often required in areas where an elevation differential exists. Therefore, the possibility of someone falling, or something falling on someone, should always be considered and mitigated.
(2) *Other Hazards.* There are numerous other hazards associated with rope rescue operations. The AHJ should make every effort to identify the hazards that might be encountered within the jurisdiction and should provide members with training and awareness of these other hazards to perform rescue operations safely and effectively.

The "general area" around a rope rescue scene is the entire area within 300 ft (91.44 m) (or more, as established by the incident commander). Making the general area safe can include, but is not necessarily limited to, the following:

(1) Controlling/limiting traffic and sources of vibration in the area
(2) Controlling/limiting access to the area by unnecessary personnel
(3) Identifying hazards and removing and/or reducing their impact

A.5.2.2(6) Other than that described in 4.4.2, specific PPE necessary for safe rope rescue operations can include, but is not limited to, the following:

(1) Harnesses
(2) Gloves appropriate for rope rescue work
(3) Helmets designed for climbing and rope rescue work

A.5.3.2 A team should prove its capability through demonstrating the ability to move a rescue load over a minimum specified distance. These distances must reflect the potential height/depth consistent with the man-made and natural structures within the response area and confirm the team's ability to meet its response needs. It is generally recommended that organizations establish a minimum travel distance for applicable techniques appropriate to the AHJ's hazard analysis.

The overall intent of the operations level in rope rescue is to have the capability to transport the rescuers and/or the victim from one stable location to another, from either above or below the position of the victim.

For the purposes of this section a "stable location" is represented by an environment where the terrain or surroundings do not present an imminent fall hazard requiring the use of a high-angle rope rescue system to support or prevent the fall of the rescuer or victim.

A.5.3.2(3) The organization must develop and implement procedures to ensure a safety systems approach to the use of rope rescue systems. Areas of management include, but are not limited to, the following:

(1) All systems are checked both visually and tactilely postconstruction or after any physical change in construction.
(2) All systems are test-loaded postconstruction prior to commitment of a live patient or rescuer on that system in a low- or high-angle environment.
(3) All personnel responsible for the operation of a system are confirmed to be "ready" prior to commitment of a live patient or rescuer on that system in a low- or high-angle environment.
(4) A method of command and control is established to ensure these systems and their operation are initiated and continued throughout the operation of rope rescue systems.

A.5.3.2(5) The requirement in 5.3.2(5) is not intended to restrict a rescue team from using two-tensioned rope systems that can be used anywhere rope-based lowering or hauling systems are required.

A.5.3.2(10) Multiple-point anchor systems at the operations level are intended to focus or position the application point of the anchor, excluding the combination of marginal anchor points.

A.5.3.2(13) Belay systems are a component of single-tensioned rope systems that apply a tensioned main system on which the entire load is suspended and a nontensioned system with minimal slack (belay) designed, constructed, and operated to arrest a falling load in the event of a main system malfunction or failure. While these traditional systems used for lowering and hauling are in common use, two-tensioned rope systems could also be used to suspend the load while maintaining near equal tension on each rope, theoretically reducing the fall distance and shock force in the event of a single rope failure.

To be effective, two-tensioned rope systems must use devices that will appropriately compensate for the immediate transfer of additional force associated with such failures.

A redundant system might include any system that provides for a belay in the event of a single system failure. In the case of single-tensioned rope systems, this is most commonly a belay system, which, by definition within this document, is a nontensioned, manually operated system designed to belay a load.

Although both lines are under tension, two-tensioned rope systems also provide a belay, which, by definition within this document, is the method by which a potential fall distance is controlled to minimize damage to equipment and/or injury to a live load.

The requirement in 5.3.2(13) is not intended to restrict a rescue team from using two-tensioned rope systems that can be used anywhere rope-based lowering or hauling systems are required.

A.5.3.2(16) This section is meant to include the use of any system that will allow the organization to mitigate a situation where a rescuer has become stranded or otherwise incapacitated while suspended or attached to a rope rescue system. These conditions can include, but are not limited to, climbing equipment malfunctions and certain entanglement hazards. Solutions can include, but are not limited to, the use of detensioning systems, application of self-rescue techniques, or even the use of technician-level procedures.

The term *self-rescue* applies to situations where conditions affecting individual team members have created an emergency that they mitigate without the aid of others.

A.5.3.2(19) This item is intended to include the movement of a loaded litter over an edge during high-angle operations. This could require constructing systems well above the edge to facilitate safe movement over the edge, or the application of techniques where there are no overhead structures.

A.5.4.2 Organizations wishing to perform rope rescues at the technician level should train and equip personnel to provide the required capabilities.

A.5.4.2(1) These techniques typically rely on the rescuer's ability to climb or rest on a structure or natural terrain that presents a significant fall hazard and requires specialized tools or training to protect the rescuer from the effects of a fall. These might include, but are not limited to, conventional lead climbing with a bottom belay, use of double lanyards, positioning belts, shepherd's hook or click sticks, and top belay methods.

A.5.4.2(2) This procedure is meant to encompass systems such as, but not restricted to, high lines, two-rope offsets, deflection, tracking, and guiding lines. A rope or similar line that is connected directly to the load being raised or lowered (often referred to as a tag line) and effectively managed by a rescuer to pull the load out and away from simple inline projections or obstructions is not intended to be a technician-level function.

A.5.4.2(3) This requirement is intended to address situations such as a patient suspended from a piece of fall protection or a piece of functional or nonfunctional climbing equipment, or entangled in, or clinging to, some part of a structure or landscape feature.

A.6.2.2(2) See A.5.2.2(2).

A.6.2.2(3) The emergency response system includes, but is not limited to, operations- and technician-level personnel, as well as local, state, and national resources.

A.6.2.2(4) These procedures should include the process of achieving and maintaining control of the site and the perimeter. This activity might include management of all civilian and nonemergency personnel and establishment of operational zones and site security.

A.6.2.2(5) See Annex E.

A.6.2.2(6) See Annex I.

A.6.2.2(7) Indications of potential for secondary collapse include, but are not limited to, the following:

(1) Leaning walls
(2) Smoke or water seeping through joints
(3) Unusual sounds (e.g., creaking, groaning)
(4) Recurring aftershocks
(5) Sagging floor or roof assemblies
(6) Missing, strained, or damaged points of connection of structural elements
(7) Excessive loading of structural elements
(8) Sliding plaster and airborne dust
(9) Separating walls
(10) Lack of water runoff
(11) Racked or twisted structure
(12) Building vibration

A.6.2.2(8) Procedures for conducting searches should include, at a minimum, visual and verbal methods.

Search and rescue operations in the structural collapse environment should include close interaction of all IMS elements for safe and effective victim extrications. Search operations for locating victims should be initiated early at a structural collapse incident. Structural collapse search operations should conform to an accepted system for victim search strategy and tactics to achieve optimum performance and effectiveness. The following recommendations provide current tactical capabilities and general strategies that can assist personnel in productive search operations.

Structural collapse operations are one of the most difficult rescue situations likely to be encountered. Depending on the complexity of the search and rescue activity, personnel might need to spend large amounts of precious time on small numbers of difficult rescues. It is important to establish whether or not rescue personnel are involved with a live victim, since the rescue of living victims should be prioritized ahead of the recovery of the remains of deceased victims.

A.6.2.2(9) See Annex F.

A.6.2.2(11) In most incidents, the collapse zone is the height of the remaining building, or building elements, plus ⅓ that height. The same is true in situations where there is a total collapse and no standing remains or where there are remains that could collapse or slide, affecting the safety of the rescuers or the operation.

A.6.2.2(12) At the awareness level, possible reconnaissance should be performed from outside the collapse zone.

A.6.3.3(1) The size-up should include, but not be limited to, the initial and continuous evaluation of the following:

(1) Scope and magnitude of the incident
(2) Risk assessment and benefit analysis
(3) Number and size of structures affected
(4) Integrity and stability of structures affected
(5) Occupancy types (e.g., residential, mercantile)
(6) Number of known and potential victims
(7) Access to the scene
(8) Environmental factors
(9) Available and necessary resources

A.6.3.3(2) Unique collapse or failure hazards can include, but are not limited to, large precariously hanging objects, extremely unbalanced floor sections where any additional weight could cause the floor section to shift or slide, or large multi-story openings or holes.

A.6.3.3(3) Organizations at the operations level should be capable of obtaining and/or utilizing one or more of the following search resources:

(1) Structural collapse search dogs
(2) Search cameras
(3) Acoustic/seismic instruments (listening devices)
(4) Thermal imaging or infrared devices
(5) Other technical search devices
(6) GPS and GIS technology
(7) Technical search specialist(s)

Some explanation of the coverage associated with various search operations is included in A.3.3.42 under the definition for the term *coverage*.

Search operations should incorporate a variety of technical and nontechnical methods that might provide personnel with the only viable method to locate victims and determine their status.

The AHJ should identify forms of technical and nontechnical search capabilities available at the local, regional, state, or national level that are commensurate with its needs. In addition to the basic operational level of capability, search methods should include, but not be limited to, the following:

(1) *Structural Collapse Search Dogs.* This involves the use of air-scent dog and handler teams trained and equipped specifically to search collapsed structures. The dog and the handler work as a team to identify the location and status of victims buried beneath rubble or structural components. It is important that the AHJ differentiate between structural collapse search dogs and other "air-scenting" dogs such as those used to search for drugs and explosives, cadaver dogs, and police K-9.
(2) *Electronic Search.* This involves the use of acoustic/seismic devices and includes the deployment of an array of two or more pickup probes around the perimeter of a collapsed structure or void area.
(3) *Search Cameras.* This involves the placement of a search camera device within a void area to search "visually" a previously nonvisible collapse zone. To use this device, ancillary tools such as rotary hammers, drills, or breakers are needed to create an opening through which the camera can be passed.
(4) *Air Sampling.* Identification of high concentrations of CO_2, for example, might indicate the presence of a live victim.

Once the AHJ has identified the location and availability of these search options at a structural collapse incident, a system should be developed to place them into operation. In conjunction with the capability of the AHJ to place into operation one or more of the previously described search methods, organizations should implement a strategic and tactical plan for the use of these devices as quickly as possible. Organizations should coordinate all available and viable tactical capabilities into a logical plan of operation. It is essential that the AHJ employ every possible search method to ensure that its members are able to locate viable victims before committing rescue resources to any prolonged (even if well-intentioned) operation. Large disaster environments can have much in common with a wilderness environment. Thus, where wide area searches are conducted in this type of environment, the use of some of the wilderness search and rescue requirements of this standard can promote rescuer safety and effectiveness.

A.6.3.3(4) Access training should include, but not be limited to, the safe and effective implementation of the following:

(1) Techniques to lift structural components of walls, floors, or roofs
(2) Rescue shoring techniques to construct temporary structures needed to stabilize and support structural components that prevent movement of walls, floors, or roofs in order to stabilize the structure and access the victims
(3) Breaching techniques to create openings in structural components of walls, floors, or roofs
(4) Operation of appropriate tools and equipment to accomplish the above tasks

A.6.3.3(5) Extrication operations at a structural collapse incident necessitate a coordinated effort that includes search, rescue, and medical capabilities. Organizations should have a working knowledge of general extrication tactics and procedures. These tactics and procedures should be flexible enough to address the specific situation and problems encountered. The AHJ should provide the appropriate training and equipment necessary to complete an extrication operation safely and effectively. These should include the following:

(1) *Manual.* Training should be provided in safe lifting techniques necessary to move manageable sections of debris and interior contents displaced by partial or complete structural collapse.
(2) *Hand Tools.* Tools and training necessary to move debris, room contents, and structural components displaced by partial or complete structural collapse should be provided. Hand tools should include, but not be limited to, pry bars, bolt cutters, jacks, and sledge hammers. Training requirements should be coordinated with the hand tool inventory.

Extrication training should include the following, as a minimum:

(1) Packaging victims within confined areas
(2) Removing victims from elevated or belowgrade areas
(3) Providing initial medical treatment to victims
(4) Operating appropriate tools and equipment to accomplish the above tasks safely and effectively

A.6.3.3(6) Emergency shoring operations for urban search and rescue incidents provide a safe and efficient atmosphere while conducting search and rescue operations for trapped victims. The intent is to provide a relatively safe and reduced–risk environment for both the victim and the trained rescue forces. The process includes stabilizing adjacent structures or objects that might have been affected by the initial incident. Figure A.6.3.3(6)(a) through Figure A.6.3.3(6)(j) depict operations–level shores that rescuers working at the operations level should be able to construct and properly install. They include T shore, double T shore, two-post vertical shore, multi-post vertical shore, door and window shore, horizontal shore, flying raker shore, split sole raker shore, solid sole raker shore, and box cribbing stacks.

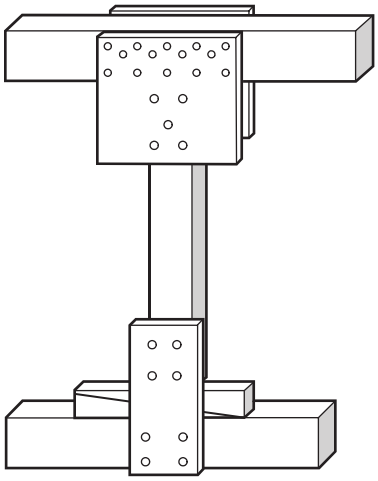


FIGURE A.6.3.3(6)(a) T Shore.

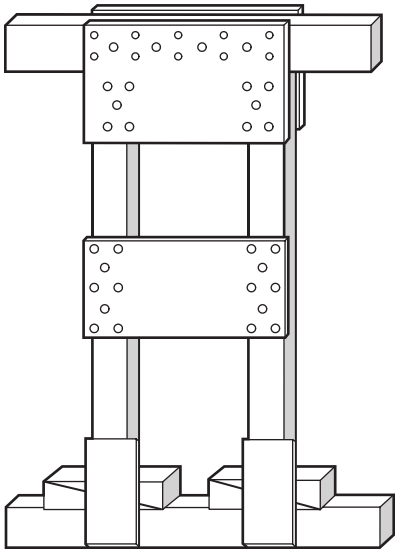


FIGURE A.6.3.3(6)(b) Double T Shore.

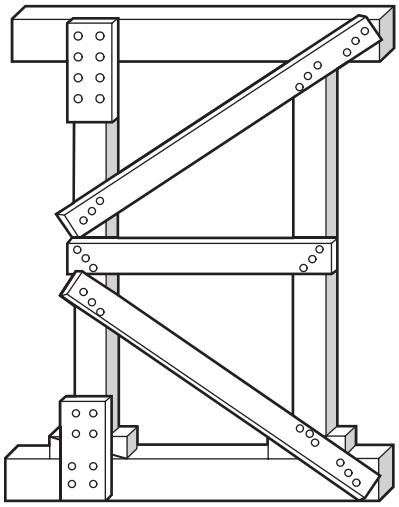


FIGURE A.6.3.3(6)(c) Two-Post Vertical Shore.

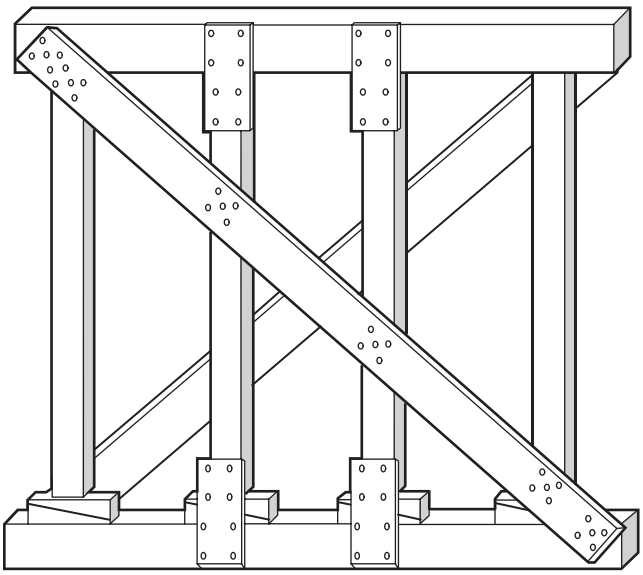


FIGURE A.6.3.3(6)(d) Multi-Post Vertical Shore.

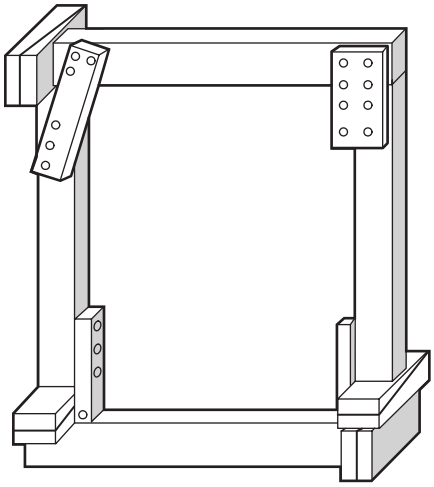


FIGURE A.6.3.3(6)(e) Door and Window Shore.

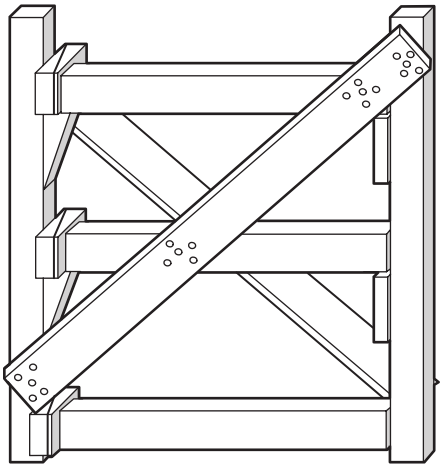


FIGURE A.6.3.3(6)(f) Horizontal Shore.

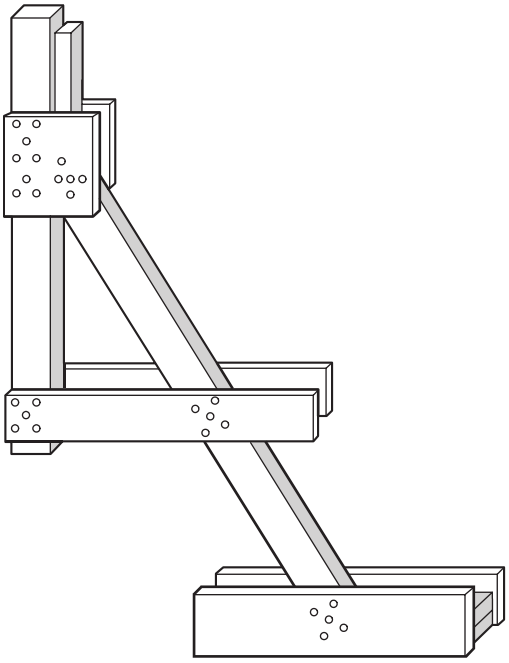


FIGURE A.6.3.3(6)(g) Flying Raker Shore.

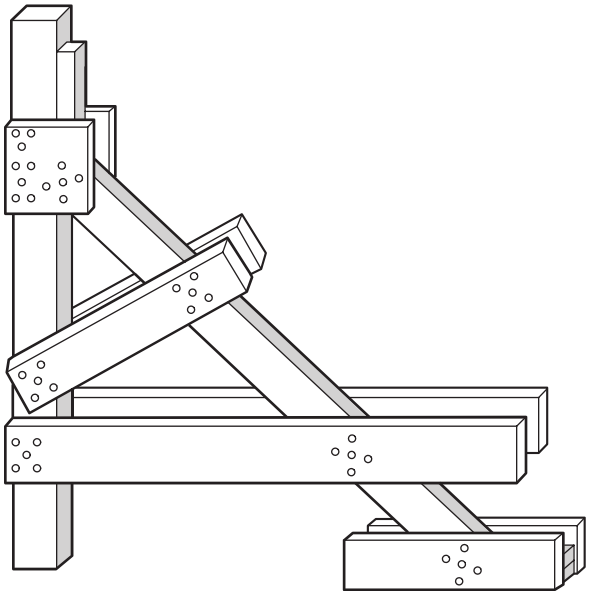


FIGURE A.6.3.3(6)(h) Split Sole Raker Shore.

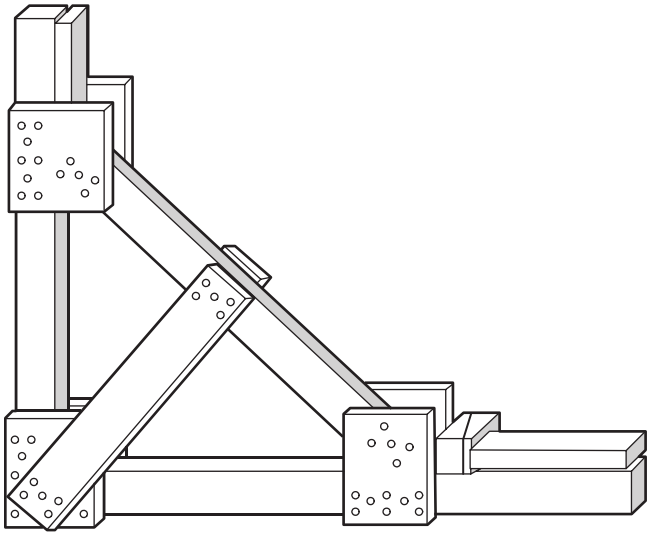


FIGURE A.6.3.3(6)(i) Solid Sole Raker Shore.

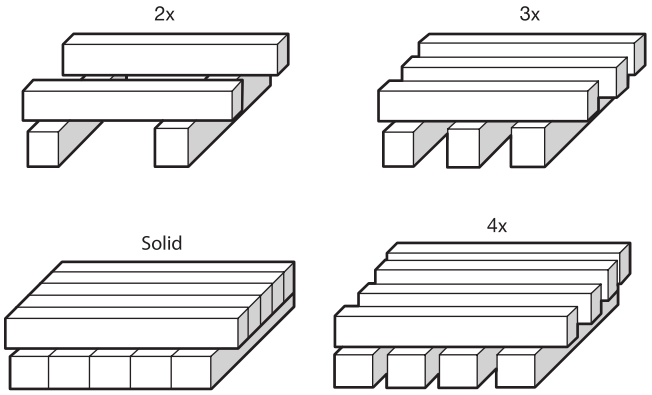


FIGURE A.6.3.3(6)(j) Box Cribbing.

A.6.4.3(3) Large disaster environments might have much in common with a wilderness environment. Thus, where wide area searches are conducted in this type of environment, the use of some of the wilderness search and rescue requirements of this standard can promote rescuer safety and effectiveness. *[See also A.6.3.3(3).]*

A.6.4.3(4) Generally, locating and extricating victims in concrete tilt-up, reinforced concrete, and steel construction is more complicated than in light-frame, ordinary construction or reinforced and unreinforced masonry construction. As structural components, materials, and weights increase, the ability to breach, stabilize, and operate within such a structural collapse becomes more hazardous, complicated, and time-consuming.

The overall ability of the AHJ to function safely and effectively is greatly dependent upon the prompt availability of appropriate tools, equipment, and supplies to accomplish operations. In concrete tilt-up, reinforced concrete, and steel construction, organizations should understand that the tools that are needed change depending on the type of structure involved. Structural collapse incidents involving these categories of construction necessitate the use of tools and equipment specifically designed for these materials, including, but not limited to, the following:

(1) Masonry saws and blades
(2) Rotary hammers and breakers
(3) Rescue air bags
(4) Dump trucks and front-end loaders
(5) Concrete saws and blades
(6) Pneumatic and hydraulic drills, hammers, and breakers
(7) Cranes
(8) Burning and cutting equipment such as oxyacetylene and exothermic or plasma cutters
(9) Bolting and anchoring systems

Power tools (e.g., air bags, hydraulic spreaders and rams, and power saws) and training necessary to breach, cut, bore, and lift structural components displaced by partial or total structural collapse should be provided.

A.6.4.3(5) See A.6.3.3(5).

A.6.4.3(6) Emergency shoring operations for urban search and rescue incidents provide a safe and efficient atmosphere while conducting search and rescue operations for trapped victims. The intent is to provide a relatively safe and reduced-risk environment for both the victim and the trained rescue force. The process includes stabilizing adjacent structures or objects that might have been affected by the initial incident. Figure A.6.4.3(6)(a) through Figure A.6.4.3(6)(f) depict technician-level shores that rescuers working at the technician level should be able to construct and properly install. They include all operations-level shores as well as laced post shore, plywood laced post shore, sloped floor shores (Type 2 and Type 3), double and triple raker shores, flying shore, and combination shores designed by a structural engineer.

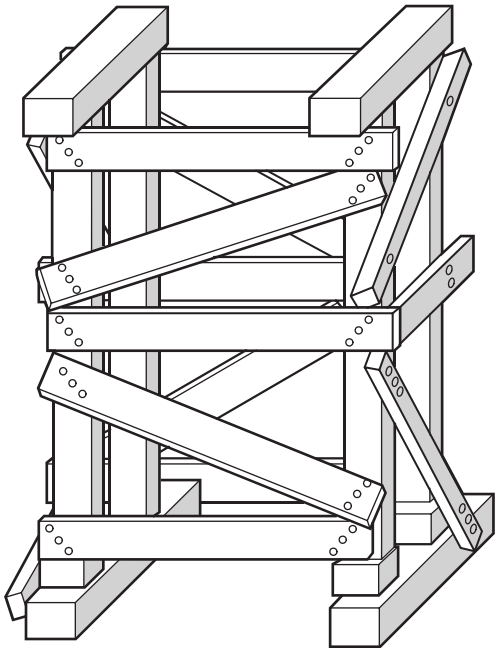


FIGURE A.6.4.3(6)(a) Laced Post Shore.

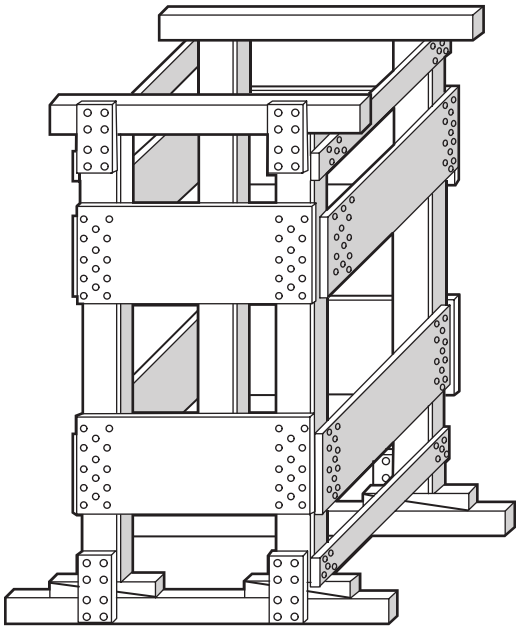


FIGURE A.6.4.3(6)(b) Plywood Laced Post Shore.

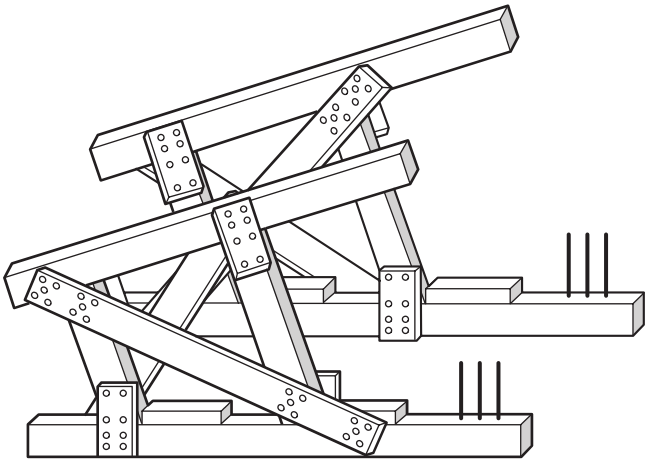


FIGURE A.6.4.3(6)(c) Sloped Floor Shore Type 2.

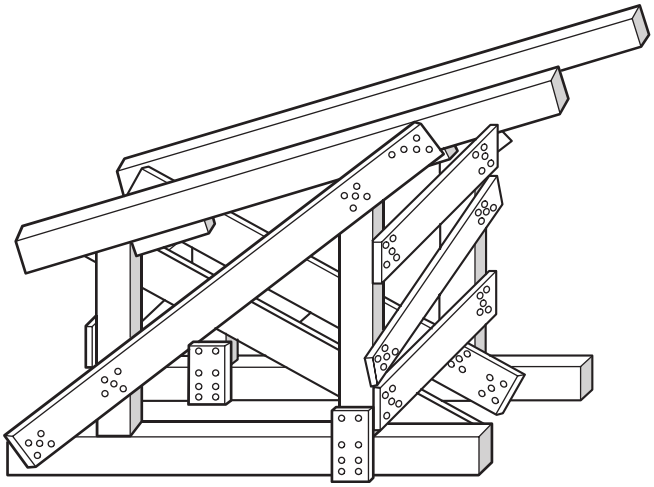


FIGURE A.6.4.3(6)(d) Sloped Floor Shore Type 3.

A.7.1.2 While much of this chapter applies to confined space rescue in industrial settings, it is intended for all incidents involving confined spaces as defined within this standard.

A.7.1.3 The term *timely* is based on many factors such as perceived danger of the original entry (e.g., possible supplied breathing air required), distance to definitive medical care, capabilities of responding emergency medical services, and so forth. In trauma-related injuries, the "golden hour" principle can be used to determine how quickly the rescue service should be able to respond to deliver the patient to the appropriate treatment facility within an hour of onset of injuries. The rescue service should have a goal of responding to these emergencies within 15 minutes of the time they receive notification.

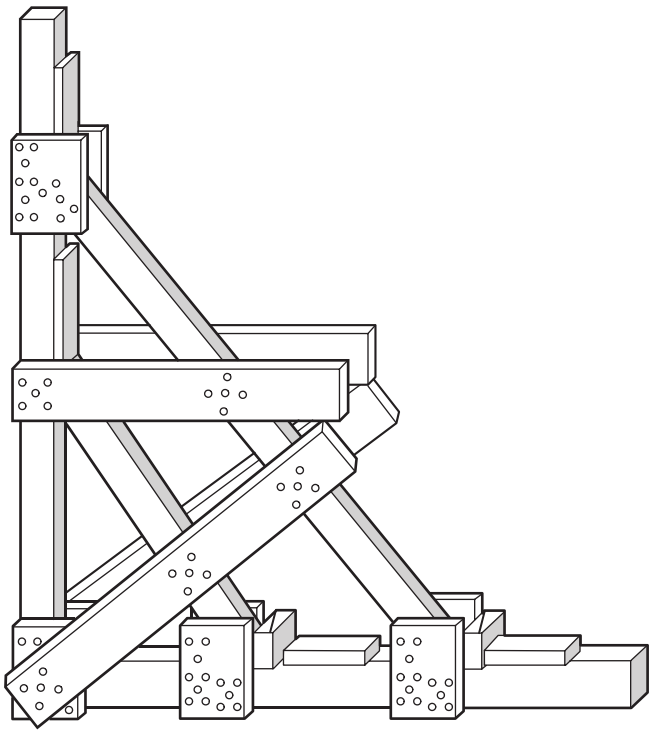


FIGURE A.6.4.3(6)(e) Double Raker Shore.

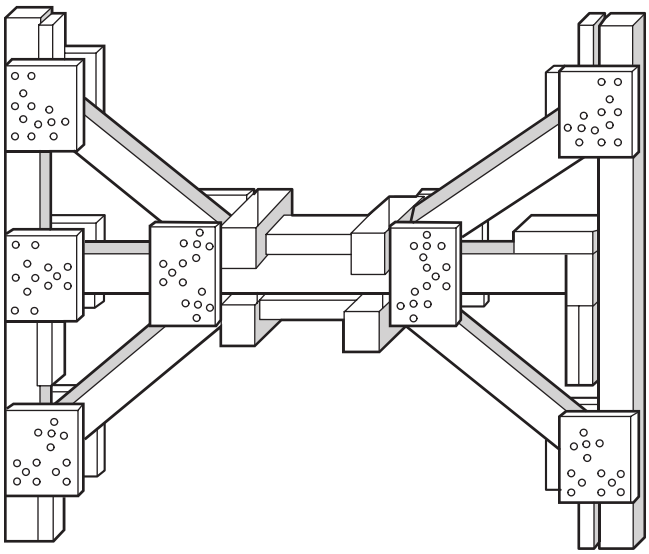


FIGURE A.6.4.3(6)(f) Flying Shore.

A.7.2.4(3) Hazards can include, but are not limited to, the following:

(1) Hazardous atmospheres
(2) Hazardous chemicals
(3) Temperature extremes

Some methods of recognition and assessment of hazards associated with confined spaces include, but are not limited to, the following:

(1) Assessment of the perimeter surrounding the confined space incident to determine the presence of or potential for a hazardous condition that could pose a risk to rescuers during approach
(2) Recognition of the need for decontamination of a patient or responder who might have been exposed to a hazardous material as per NFPA 470 and OSHA regulations in 29 CFR 1910.120, "Hazardous Waste Operations and Emergency Response" (HAZWOPER)
(3) Recognition of the need for a confined space rescue service or additional resources when nonentry retrieval is not possible
(4) Notification of the designated rescue service and other resources necessary for initiation of confined space rescue
(5) Recognition of hazardous atmospheres or materials through visual assessment and information received from on-site personnel

A.7.2.4(4) The term *confined space* as defined within this standard is synonymous with the term *permit-required confined space* or *permit space* used by many U.S. federally regulated agencies.

A.7.2.4(5) Retrieval includes the operation of common nonentry retrieval systems. Examples include simple winch and block devices used in conjunction with tripods, quadpods, or other manufactured portable anchor systems. A nonentry retrieval can simply involve operating the crank on a winch/tripod system where anchors and protection systems are already in place.

A.7.2.4(6) The emergency response system includes, but is not limited to, operations- and technician-level organizations capable of responding to various types of search and rescue incidents, as well as local, state, and national resources. In addition, the system includes procurement of on-site information resources such as witnesses, industrial entry supervisors, industrial facility managers, engineers, or other responsible persons. Printed on-site information resources available at many U.S. federally regulated industrial facilities can include, but are not limited to, the following:

(1) Entry permit
(2) Chemical information documents (i.e., SDS)
(3) Other site work permits

A.7.2.4(7) These procedures should include the process of achieving and maintaining control of the site and the perimeter. This process might include management of all civilian and nonemergency personnel and establishment of operational zones and site security. The organization should also assure through written standard operating guidelines that the scene is rendered safe at the termination of the incident.

A.7.3.2.1 In general, confined space rescue teams are composed of no less than six members to perform all the required functions listed. However, the size and capability of a team required to perform a specific rescue will depend on many factors, including the condition of the patient, the size and shape of the space, size of the access opening, and the hazards present. The positions described in 7.3.2.1(1) through 7.3.2.1(4) describe the minimum number of exclusive roles that must be filled to perform an entry-type rescue. Many rescues will require additional functions such as ventilation, rope rescue support, or communication that will require additional trained resources. Pre-incident planning of representative spaces is a key element in determining the size and capabilities of the team.

A.7.3.2.1(1) Entry team size will be driven by the size of the space and the degree of difficulty of the rescue operation. While at the operations level the entry team size should be no less than two members, some spaces requiring technician-level resources could be only large enough to accommodate a single rescuer. Some incidents might involve large spaces or complex rescue operations that will require several rescuers to enter the space.

A.7.3.2.1(2) The intent of the backup team is to quickly and effectively remove an incapacitated rescuer who is unable to perform self-rescue. In general, this requires no less than two members immediately available to enter the space equipped with the same or greater level of PPE as the entry team. The size and capability of the team should be driven by the specific conditions encountered and the scope of the rescue operation.

A.7.3.2.2(1) The intent of 7.3.2.2(1) is to limit the danger of entanglement.

A.7.3.2.2(2) The intent of 7.3.2.2(2) is to ensure that the attendant can maintain direct observation of the entrants at all times, making recognition of problems more rapid.

A.7.3.2.2(3) The intent of 7.3.2.2(3) is to allow for easier retrieval of rescue entrants should this become necessary and to provide for passage through the opening without removal of necessary PPE, including fresh-air breathing apparatus.

A.7.3.2.2(4) The intent of 7.3.2.2(4) is to allow a "buddy system" to be employed, providing potentially faster response to a problem with one of the rescue entrants.

A.7.3.2.2(5) The intent of 7.3.2.2(5) is to ensure that hazards to rescuers in organizations at this level are kept to an absolute minimum.

A.7.3.5 The requirement in 7.3.5 provides for training necessary to gain proficiency for every size, type, and configuration of confined space to which an agency must respond. This means training once every 12 months for each type of space to which the agency must respond. Similar spaces can be grouped, where applicable, to provide for efficient use of training time. For example, for vessels located in many areas of a jurisdiction that are similar with respect to accessibility and internal configuration but with different size openings, practice need only be with a variety of openings to satisfy this requirement. It is not necessary or practical to practice on literally every space; rather it should be ensured that the response agency is proficient enough to handle emergencies in the spaces within its jurisdiction.

A.7.3.7(1) The assessment at this level should include, but not be limited to, the initial and continuous evaluation of the following:

(1) Hazards such as engulfment potential, environmental hazards (e.g., chemical, atmospheric, temperature),

harmful forms of energy (e.g., electrical, mechanical, movement due to gravity, hydraulic), configuration hazards (e.g., diverging walls, entrapment, obstructions, trip/fall hazards), and so forth
(2) Risk/benefit analysis (body recovery versus rescue)
(3) Available/necessary additional resources
(4) Establishment of control zones
(5) Magnitude of the hazard and isolation procedures
(6) Effectiveness of the nonentry or qualifying entry–type rescue
(7) Overall safety of rescue operations
(8) Level of rescue response (appropriate for the type of rescue being attempted)
(9) Current and projected status of the planned response
(10) Personnel accountability

A site safety plan can also provide useful information for consideration during size-up and should include the following:

(1) Rescue team notification
(2) Acceptable entry conditions for rescue
(3) Hazard identification
(4) Risk assessment of hazards
(5) Site map
(6) Hazard abatement (including control zones, ventilation, and lockout/tagout procedures)
(7) Use of buddy system (where applicable)
(8) Communications (e.g., site, rescue attendant to rescue entrant)
(9) Command post
(10) Incident management organizational chart
(11) Standard operating guidelines
(12) Safe work practices
(13) Medical assistance
(14) Pre-entry safety briefings
(15) Pre- and postentry physicals (if indicated)

A.7.3.7(2) See Annex G.

A.7.3.7(3) The AHJ should address the possibility of members of the organization having physical and/or psychological disorders (e.g., physical disabilities, fear of heights, fear of enclosed spaces) that could impair their ability to perform rescue in confined spaces.

A.7.3.7(4) Roles, functions, and responsibilities for these team positions should be consistent with the organization's standard operating guidelines for confined space rescue.

A.7.3.7(5) Personnel meeting the requirements of NFPA 470 should perform the monitoring procedures even if such personnel are not part of the rescue team. Monitoring the atmosphere can include the following considerations:

(1) Acceptable limits for oxygen concentration in air should be between 19.5 percent and 23.5 percent. An oxygen-enriched atmosphere is considered to be greater than 23.5 percent and poses a flammability hazard. An oxygen-deficient atmosphere is considered to be lower than 19.5 percent and can lead to asphyxiation without fresh-air breathing apparatus.
(2) Flammability is measured as a percentage of a material's lower explosive limit (LEL) or lower flammable limit (LFL). Rescuers should not enter confined spaces containing atmospheres greater than 10 percent of a material's LEL regardless of the PPE worn. There is no adequate protection for an explosion within a confined space.
(3) Acceptable toxicity levels are specific to the hazardous material involved, and chemical properties should be assessed to determine the level of the hazard for a given environment and time frame.

The confined space rescue team at the operations level should have available resources capable of understanding the assessment tools necessary for analysis and identification of hazardous conditions within confined spaces and interpretation of that data. This capability should include at least the following:

(1) Identification of the hazards found within confined spaces and understanding how those hazards influence victim viability and rescue/recovery operations
(2) Selection and use of monitoring equipment to assess the following hazards:
    (a) Oxygen-deficient atmospheres
    (b) Oxygen-enriched atmospheres
    (c) Flammable environments
    (d) Toxic exposures
    (e) Radioactive exposures
    (f) Corrosive exposures
(3) Understanding of the limiting factors associated with the selection and use of the atmospheric and chemical monitoring equipment provided by the AHJ for confined space emergencies. The factors determined by this equipment include, but are not limited to, calibration, proper operation, response time, detection range, relative response, sensitivity, selectivity, inherent safety, environmental conditions, and the nature of the hazard. This equipment could include, but is not limited to, the following:
    (a) Calorimetric tubes
    (b) Oxygen concentration monitor (continuous reading, remote sampling)
    (c) Combustible gas monitor (continuous reading, remote sampling)
    (d) Specific toxicity monitor (continuous reading, remote sampling)
    (e) Multigas atmospheric monitors (continuous reading, remote sampling)
    (f) Passive dosimeter
    (g) pH papers, pH meters, and pH strips
    (h) Radiation detection instruments
(4) Utilization and evaluation of reference terms and resources to include, but not be limited to, the following:
    (a) Lethal concentration-50 (LC-50)
    (b) Lethal dose-50 (LD-50)
    (c) Permissible exposure limit (PEL)
    (d) Threshold limit value (TLV)
    (e) Threshold limit value — short-term exposure limit (TLV-STEL)
    (f) Threshold limit value — time-weighted average (TLV-TWA)
    (g) Immediately dangerous to life and health (IDLH)
    (h) Chemical information documents (i.e., SDS)
    (i) Reference manuals
    (j) Computerized reference databases
    (k) Technical information centers
    (l) Technical information specialists
    (m) Monitoring equipment

A.7.3.7(6) The intent of 7.3.7(6) is to restrict entries made by operations-level organizations to those that would absolutely minimize risk to rescue entrants.

A.7.3.7(7) Packaging devices that can be used in confined spaces include, but are not limited to, the following:

(1) Full spine immobilization devices
(2) Short spine immobilization devices
(3) Cervical spine immobilization devices
(4) Litters
(5) Prefabricated full-body harnesses
(6) Tied full-body harnesses
(7) Wrist loops (wristlets)

A.7.3.7(8) Organizations at the operations level are expected to safely apply lowering and raising systems (rope- or nonrope-based) as appropriate during confined space emergencies. These applications can involve the use of rope rescue systems in the high-angle environment to both lower rescuers into and remove rescuers and victims from confined spaces. The determination of what systems are most appropriate to accomplish these tasks should be dictated by the circumstances surrounding the incident.

A.7.4.2.1(3) The need for fresh air breathing apparatus in confined space rescue operations is well-known. However, the technician level organization must be aware that the use of self-contained breathing apparatus (SCBA) might not be appropriate in spaces that do not allow adequate portal size or interior area to perform rescue procedures. The removal of SCBA to make entry into these restricted areas constitutes a significant safety hazard in that it allows greater potential for compromise of the unit's facepiece seal. Technician-level organizations should become proficient in the use of supplied-air respirators (SAR) with emergency egress cylinders so that they can enter these more restricted confined spaces for rescue without compromising their own safety.

A.7.4.3(2) See Annex G.

A.7.4.3(3) See Annex G.

A.8.1 It is the intent of this provision that the AHJ, as part of the hazard identification and risk assessment, identify the types of vehicles within its response area. These types can include, but are not limited to, cars, trucks, buses, trains, mass transit systems, aircraft, and watercraft. The AHJ should develop procedures and provide training to personnel that are commensurate with the potential for search and rescue situations involving the above-mentioned vehicles.

A.8.2.3(2) See A.4.3.5.

A.8.2.3(3) The emergency response system includes, but is not limited to, operations- and technician-level organizations capable of responding to various types of search and rescue incidents, as well as local, state, and national resources.

A.8.2.3(4) These procedures should include the process of achieving and maintaining control of the site and the perimeter. They might include management of all civilian and nonemergency personnel and establishment of operational zones and site security.

A.8.2.3(5) General hazards associated with operations at vehicle search and rescue incidents can present the AHJ with uniquely challenging situations. The AHJ should consider the following potential hazards when providing training to its members:

(1) Fire or explosion
(2) *Utilities.* Control of the utilities in and around a vehicle search and rescue incident is critical to ensure the safety of responding personnel and victims. The AHJ should provide its members with training in the control of these services to provide a safe environment in which to operate and to ensure the safety of victims. The following utilities should be considered when providing training:
    (a) Electrical services (primary and secondary)
    (b) Gas, propane, fuel oil, or other alternative energy sources (primary systems)
    (c) Water
    (d) Sanitary systems
    (e) Communications
    (f) Secondary service systems (such as compressed, medical, or industrial gases)
(3) *Hazardous Materials.* Vehicle rescue incidents might include various materials that, when released during an incident, could pose a hazard to victims and responders. The AHJ should provide members with training in the recognition of potential hazardous material releases, the determination of an existing hazard, and the methods used to contain, confine, or divert hazardous materials to conduct operations safely and effectively.
(4) *Personal Hazards.* At the site of any vehicle search and rescue incident, there are many dangers that pose personal injury hazards to the responders. The AHJ should train members to recognize the personal hazards they encounter and to use the methods needed to mitigate these hazards to help ensure their safety. Every member should be made aware of hazards such as trips, falls, blows, cuts, abrasions, punctures, impalement, and so forth.
(5) *Movement of Vehicle(s).* Uncontrolled movement of vehicle(s) can cause extremely hazardous and potentially fatal situations. Responding personnel should be familiar with and trained in techniques for stabilizing and removing the potential for movement of vehicle(s).
(6) *Release of High-Pressure Systems.* Vehicles often include high-pressure systems (e.g., hydraulic, pneumatic) that can fail without warning. Such failure can cause extremely hazardous conditions, injury, and death of victims and responders. The AHJ should provide members with training in the recognition of potential high-pressure system hazards, the determination of an existing hazard, and the methods used to contain, confine, or divert such hazards to conduct operations safely and effectively.
(7) *Blood and Body Substances.* Vehicle incidents typically result in injury to occupants of the vehicle or those in the vicinity. The AHJ should train its members on procedures and equipment used to protect the responder from communicable diseases that are known to be transmitted through blood and other body substances. This equipment usually includes the use of fluid impervious gloves, goggles, masks, and gowns/coveralls.
(8) *Hybrid, Electric and Alternative Propulsion Systems.* Vehicles that use power sources separate from and in addition to conventional internal combustion engines can present hazards to untrained responders even if the vehicle is not compromised. AHJ should provide training to its members on recognition of these propulsion systems and how to safely operate in and around them.

(9) *Other Hazards.* There are numerous other hazards associated with vehicle search and rescue incidents. The AHJ should make every effort to identify the hazards that might be encountered within the jurisdiction and should provide members with training and awareness of these other hazards to allow them to perform search and rescue operations safely and effectively.

A.8.3.3 This is intended to represent vehicles the agency and its members will be routinely exposed to during emergency work and whose configurations, hazards and systems are familiar and commonplace. For nearly every AHJ, this is intended to reflect the common passenger car or light truck. However, some specialized agencies such as industrial fire brigades or airport fire departments routinely respond to incidents involving other types of vehicles, depending on their location or specific mission.

A.8.3.4(1) The size-up should include, but not be limited to, the initial and continuous evaluation of the following:

(1) Scope and magnitude of the incident
(2) Risk/benefit analysis (body recovery versus rescue)
(3) Number and size of vehicles affected
(4) Integrity and stability of vehicles affected
(5) Number of known or potential victims
(6) Access to the scene
(7) Hazards such as disrupted or exposed utilities, standing or flowing water, mechanical hazards, hazardous materials, electrical hazards, and explosives
(8) Exposure to traffic
(9) Environmental factors
(10) Available versus necessary resources

A.8.3.4(3) The search and rescue area is that area immediately surrounding [within approximately a 20 ft (6 m) radius of] the vehicle. Making the search and rescue area safe includes, but is not limited to, the following actions (however, specific actions should be based on the vehicle and the specific situation):

(1) Establishing operational zones (i.e., hot, warm, cold) and site security
(2) Utilizing specific techniques and tools (including cribbing, chocks, and wedges) to stabilize the vehicle
(3) Utilizing specific techniques and tools to control the hazards presented by the vehicle, its energy source, propulsion system, or other intrinsic sources of stored energy
(4) Making the search and rescue area (i.e., hot zone) safe for entry
(5) Safely undertaking disentanglement and extrication operations using hand tools
(6) Ventilating the search and rescue area and monitoring its atmosphere when necessary
(7) Supporting any unbroken utilities
(8) Providing protective equipment for any victims, if possible, when necessary
(9) Prohibiting entry into an unsafe vehicle search and rescue area
(10) Preventing the touching or operating of equipment involved until its safety has been established

"Control" is intended to include strategies that actively identify the hazard to those in the area and to exclude responders from the area of influence it presents.

A.8.3.4(4) The use of nonsparking tools should be considered where a flammable atmosphere exists.

A.8.3.4(7) See A.8.3.3.

A.8.3.4(8) To ensure a safe disentanglement or extrication operation, the AHJ should provide training on the following topics:

(1) Types of passenger restraint systems, especially supplemental restraint systems such as airbags
(2) Frame and construction features of vehicles
(3) Types of suspension systems in vehicles
(4) Types and classification of impacts
(5) Categories of mechanical injury
(6) Various stabilization techniques
(7) Center of gravity and its relationship to rollover
(8) Use of cribbing and chocks
(9) Building a crib box
(10) Types and examples of levers for mechanical advantage
(11) Proper and effective use of hand tools, including a hammer, pry bar, hacksaw, glass punch, Halligan, knife or belt cutter, cable cutter, and come-along
(12) Disentanglement through primary access points
(13) Patient packaging prior to removal from a vehicle
(14) Protection of the victim during extrication or disentanglement operations
(15) Proper and effective use of power tools such as hydraulic, pneumatic, and electrical spreading, cutting, lifting, and ram-type tools
(16) Alternative propulsion systems that use power sources other than conventional gas or diesel internal combustion engines (*See also A.8.3.3.*)

A.8.3.4(9) These procedures refer to the mitigation and management of the hazards identified in A.8.2.3(5). See A.8.3.3 for the types of vehicles covered. Responders at the operations level are not expected to manage exotic, unfamiliar or multiple concurrent hazards. Examples would include the following:

(1) Unstable vehicles in unconventional positions, such as those on their top or side
(2) Vehicles in trenches or excavations
(3) Vehicles located where rope rescue skills are required for access

A.8.4.2(2) To ensure that disentanglement or extrication from large, heavy vehicles is performed safely, the AHJ should provide training on the following topics:

(1) Frame and construction features of heavy, large vehicles
(2) Use and components of a search and rescue chain assembly
(3) Pneumatic high-, medium-, and low-pressure lifting bags
(4) Use, care, and maintenance of wire rope and its associated equipment
(5) Large and heavy object weight estimation
(6) Steps necessary to lift or move large objects
(7) Use of cribbing and chocks with large and heavy objects
(8) Use of commercial heavy wreckers and recovery services to assist at incidents involving large transportation vehicles
(9) Use, care, and maintenance of both manual and power winches
(10) Types and examples of lifting devices that use mechanical advantage principles
(11) Proper and effective use of power tools, including hydraulic, pneumatic, and electrical spreading, cutting, lifting, and ram-type tools

(12) Disentanglement through both primary and secondary access points through the use of available power tools
(13) Protection of the victim during this type of extrication or disentanglement operation
(14) Identification and use of various sling configurations

A.8.4.2(3) "Specialized search and rescue equipment" can include, but is not limited to, hydraulic, pneumatic, and electrical spreading, cutting, lifting, and ram-type tools immediately available and in use by the organization. Power tools should be provided and can include, but are not limited to, air bags, hydraulic spreaders and rams, hand tools, and other power tools and training necessary to remove, cut, and move components displaced at a vehicle search and rescue incident.

A.9.1 See Annex J, Animal Rescue.

A.9.4.5(3) This might include a variety of options, including manipulation of a large animal packaged in a litter through a low-angle environment or use of a highline for a small animal. The use of highlines for large animal loads is not recommended as an accepted practice.

A.9.4.5(5) This requirement implies the use of any system in the high-angle environment that will deflect the packaged animal from the vertical plane, including, but not limited to, tag lines. Rescuers should not attempt to be on a rope system with large animals.

A.10.1.2 What is and is not considered "wilderness" can change with any particular combination of weather, terrain, and hazards that make it difficult to locate, access, and/or evacuate the subject.

A.10.2.3(2) The emergency response system includes, but is not limited to, operations- and technician-level organizations capable of responding to various types of search and rescue incidents, as well as local, state, and national resources.

Wilderness search and rescue responses often involve multiple organizations in the initial response when the subject's location, the terrain involved, and the environmental conditions are unknown, unconfirmed, or different than initially reported. Wilderness incidents are also resource intensive. Due to the number of resources responding, the response organization should be trained and equipped to initiate an incident management system while en route rather than waiting until personnel arrive.

A.10.2.3(3) Training should address the process of achieving and maintaining control of all ingress and egress of the trailhead or road head. This control might include management of all civilian and nonemergency personnel and establishment of operational zones and site security.

A.10.2.3(4) General hazards associated with search and rescue operations in the wilderness can present the AHJ with uniquely challenging situations. The AHJ should consider the following potential hazards and, to help provide for their safety, ensure that members have the ability to recognize potential hazards that they can encounter.

(1) *Personal Hazards.* In the wilderness environment, there are many dangers that pose personal injury and physiological hazards to responders. Personnel should be made aware of hazards including, but not limited to, blisters, scrapes, scratches, falls, blows, bruises, dehydration, heat and cold-related injuries, and so forth.
(2) *Environmental Hazards.* Depending on the specific environment, there are many dangers that pose hazards to responders. Personnel should be made aware of hazards including, but not limited to, insect bites and stings, poisonous plants, exposure injuries (cold and heat), snow blindness, altitude illness, lightning, sunburn, dangerous wildlife, and so forth.
(3) *Terrain Hazards.* Specific features in an environment can pose hazards to responders. Personnel should be made aware of hazards including, but not limited to, cliffs, avalanches, standing water (e.g., ponds, lakes), flat ice (e.g., ponds, lakes), moving water (e.g., rivers, streams), caves, mines, wells, high winds, snow (blowing and fallen), coastal white water surf, and so forth.
(4) *Man-Made Hazards.* Humans, whether intentionally or accidentally, can also cause unsafe conditions in the wilderness. Personnel should be made aware of hazards including, but not limited to, booby-trapped stills and labs (covert ethanol and drug production), hazardous materials dumps, trained attack dogs (protecting drug labs), remotely managed water ways, and so forth.

A.10.2.3(6) Conventional emergency response PPE and other equipment (especially fire-related equipment) are often inappropriate for use in a wilderness setting. For instance, fire helmets and boots can increase one's potential for injury in the wilderness. Conventional emergency response skills such as using a sphygmomanometer and using an ambulance cot have very little application in the wilderness. Therefore, such skills and equipment will require modification to achieve the rescuer's desired goals in the wilderness.

A.10.2.3(7) Documents for the collection and recording of information can include the following:

(1) Information regarding the lost or missing person(s)
(2) Information needed to determine search urgency
(3) Information required by the AHJ
(4) Information required by the IMS
(5) Information required to identify a subject's track (i.e., footprint)
(6) Information for development of the search and rescue response strategy

A.10.2.3(8) Isolation includes keeping the reporting party readily available for interviewers and isolated from media and the incident operations, as well as isolated from one another, in the case of multiple reporting parties.

A.10.3.2 In some cases, where minimum exposure to wilderness hazards exists, it can be appropriate for the AHJ to establish SOPs that permit an operations-level organization to conduct certain search and rescue operations without supervision of a technician-level organization.

A.10.3.4(1) The size-up should include, but not be limited to, the initial and continuous evaluation of the following:

(1) Scope and magnitude of the incident, including whether it is a search, rescue, or body recovery
(2) Assessment of time required
(3) Assessment of staffing needs
(4) Specific environmental factors involved
(5) Integrity and stability of the environment involved
(6) Number of known/potential victims
(7) Environmental conditions (current and forecast)
(8) Urgency (based on the type of known/potential victims)
(9) Available/necessary resources

A.10.3.4(2) Resources can include but are not limited to the following:

(1) Search dogs
(2) Trackers
(3) Aircraft
(4) Ground/air search specialists
(5) Rope rescue specialists
(6) Water search and rescue specialists
(7) Trench rescue specialists
(8) Vehicle/machinery rescue specialists
(9) Collapsed building search and/or rescue specialists
(10) Emergency incident management (overhead) teams
(11) Avalanche rescue specialists
(12) Cave rescue specialists
(13) Mine rescue specialists
(14) Other technical search and/or rescue providers and managers

A.10.3.4(4) Body management refers to the skills and knowledge involved in maintaining personal nutrition, hydration, rest, and other physiological requirements of the human body.

A.10.3.4(7) Personal support equipment should include that which is necessary to address the following needs, or potential needs, of a responder in a wilderness setting:

(1) Personal medical (first aid) supplies
(2) Additional clothing appropriate for anticipated environment/weather
(3) Fluids and food appropriate for mission duration
(4) Personal safety and comfort gear (e.g., flashlight, sunglasses, sunscreen)
(5) Navigation tools (e.g., compass, map)
(6) General marking and documentation tools (e.g., flagging tape, paper/pencil)
(7) Improvisational tools (e.g., wire, twine, leaf bag, safety pin)
(8) Emergency shelter, bivouac, and/or body protection
(9) Communications including emergency back-up (e.g., whistle, radio, flare)
(10) Pack to carry and protect contents (e.g., belt pack, rucksack)

A.10.3.4(11) The AHJ should establish procedures for negotiating and/or avoiding conditions and hazards specific to the wilderness environments and terrains in which rescuers can become involved. It is likely that some conditions and/or situations will exceed the capability of the organization. In such situations, additional, more experienced, specialized, or highly trained resources should be procured. *[See also A.10.3.4(16).]*

A.10.3.4(12) The National Search and Rescue Committee recommends using the georeferencing (coordinate) systems shown in Table A.10.3.4(12).

A.10.3.4(16) Knowledge and skills involved in supporting and participating in a search should include, but are not limited to, the following:

(1) Hasty, low coverage, and high coverage search techniques
(2) Principles of confinement of the search area
(3) Principles and importance of clue awareness
(4) Basic search theory application and terminology
(5) Principles of lost person behavior
(6) Procedures for serving as an air observer (e.g., searching from an aircraft)
(7) Procedures for handling, processing, and documenting evidence

A.10.3.4(21) Responders should be able to assess limitations in accessing and/or evacuating the subject based on the following:

(1) Individual and team expertise
(2) Qualified personnel available
(3) Ability to communicate from the subject's location
(4) Anticipated staffing and time

A.10.4.2 See *Mountain Rescue Association Policies,* "Policy 105: Personnel Guidelines."

A.10.4.4 Some examples would be search, cave, and alpine.

A.10.4.7(4) Technician-level responders should be adept and experienced at awareness and operations level skills. Teams operating at the technician level should have the capability to address any potential operation that falls within their jurisdiction. To accomplish this, responders at the technician level should be personally adept at wilderness skills, travel, and operations in the wilderness setting.

A.10.4.7(5) Such an operational plan should be based on the hazard identification and risk assessment performed according to Section 4.2, available resources, environmental influences and conditions, and the urgency of the situation. Specifically with regard to a search, the implemented plan should involve planning and search management techniques including, but not necessarily limited to, the following:

(1) Determining the urgency of the search
(2) Developing a lost subject profile
(3) Establishing the search area and correctly dividing it into regions and segments as necessary
(4) Conducting an appropriate investigation and interviews
(5) Applying the mathematical concept of probability and search theory
(6) Designing, developing, implementing and monitoring appropriate search strategy and tactics
(7) Establishing and managing appropriate support camps
(8) Briefing and debriefing of operational personnel properly and thoroughly
(9) Considering suspension of the search when appropriate
(10) Demobilizing personnel and facilities
(11) Documenting the incident properly

A.10.4.8 Technician-level wilderness search and rescue incidents require a substantially greater demand on the personnel responding and can require the following:

(1) Endurance
(2) Capability to operate at high altitude
(3) Capability to operate in situations involving extreme elevation differences
(4) Equipment for extreme conditions
(5) Previous experience in the extreme wilderness environment

A.11.2.3(3) See A.5.2.2(2).

A.11.2.3(4) The emergency response system includes, but is not limited to, operations- and technician-level organizations capable of responding to various types of search and rescue incidents, as well as local, state, and national resources.

Table A.10.3.4(12) National SAR Committee's Georeferencing

Georeference System User	United States National Grid (USNG)	Latitude/Longitude DD-MM.mm[a]	GARS[b]
Land SAR Responder[c]	Primary	Secondary	N/A
Aeronautical SAR Responders[d]	Secondary	Primary	Tertiary
Air Space Deconfliction[e]	N/A	Primary	N/A
Land SAR Responder/ Aeronautical SAR Responder Interface[f]	Primary	Secondary	N/A
Incident Command:			
Air SAR Coordination	Secondary	Primary	N/A
Land SAR Coordination	Primary	Secondary	N/A
Area organization and accountability[g]	Secondary	Tertiary	Primary

[a]During CISAR operations (and to avoid confusion) latitude and longitude should be in one standard format: DD-MM.mm. If required, use up to 2 digits to the right of the decimal. If required, allow 3 digits in the degrees field for longitude (i.e., DDD-MM.mm). Do not use leading zeros to the left of the decimal for degrees or minutes that require fewer than the maximum number of possible digits to express their value. The minimum number of digits is always one, even if it is a zero. (Example: Recommended: 39°36.6'N 76°51.42'W; Not recommended: 39°36.600'N 076°51.420'W).

[b]GARS: Global Area Reference System.

[c]Land SAR responders use U.S. National Grid. However, a good familiarity with latitude and longitude is necessary to ensure effective interface between land and aeronautical SAR responders. (Note: Land SAR includes SAR on flooded terrain.)

[d]Aeronautical SAR responders will use latitude and longitude for CISAR response. However, aeronautical SAR responders that work directly with land SAR responders should understand the U.S. National Grid system for effective land SAR/aeronautical SAR interface.

[e]Air space deconfliction will *only* be implemented and managed using latitude and longitude.

[f]Aeronautical SAR responders working with land SAR responders have the primary responsibility of coordinating SAR using USNG. However both groups must become familiar with both georeference systems.

[g]Describes the requirement for providing situational awareness of CISAR operations geographically to federal, military, state, local, and tribal leadership. Provides for quick reference to send SAR resources closest to the incident.

A.11.2.3(5) These procedures should include the process of achieving and maintaining control of the site and the perimeter. This control might include management of all civilian and nonemergency personnel and establishment of operational zones and site security.

A.11.2.3(6) General hazards associated with search and rescue operations at trench and excavation collapses can present the AHJ with uniquely challenging situations. The AHJ should consider the following potential hazards when providing training to its members:

(1) *Utilities.* Control of the utilities in and around a trench or excavation emergency is critical to ensure the safety of responding personnel and victims. The AHJ should provide its members with training in the control of these services to provide a safe environment in which to operate and to ensure the safety of victims. The following utilities should be considered when providing training:
   (a) Electrical services (primary and secondary)
   (b) Gas, propane, fuel oil, or other alternative energy sources (primary systems)
   (c) Water/steam
   (d) Sanitary systems
   (e) Communications
   (f) Secondary service systems (such as compressed, medical, or industrial gases)

(2) *Hazardous Materials.* Excavations might include various materials unique to a site that, when released during a collapse, could pose a hazard to victims and responders. The AHJ should provide members with training in the recognition of potential hazardous material releases, the determination of an existing hazard, and the methods used to contain, confine, or divert hazardous materials to conduct operations safely and effectively.

(3) *Personal Hazards.* At the site of any trench or excavation collapse, there are many dangers that pose personal injury hazards to the responders. The AHJ should train members to recognize the personal hazards they encounter and to use the methods needed to mitigate these hazards to help ensure their safety. Every member should be made aware of hazards such as trips, falls, blows, punctures, impalement, and so forth.

(4) *Confined Space.* All trench and many excavation collapses necessitate a confined space rescue. Responding personnel should be familiar with and trained in confined space rescue requirements and techniques. The AHJ should determine the applicable laws and standards related to

confined space rescue and should provide training to members in confined space rescue.

(5) *Other Hazards.* There are numerous other hazards associated with trench and excavation collapses. The AHJ should make every effort to identify the hazards that might be encountered within the jurisdiction and should provide members with training and awareness of these other hazards to allow them to perform rescue operations safely and effectively.

The "general area" around a trench or excavation emergency is the entire area within 300 ft (92 m) (or more, as established by the incident commander). Making the general area safe includes, but is not necessarily limited to, the following:

(1) Controlling/limiting traffic and sources of vibration in the area, including shutting down all vehicles and equipment
(2) Controlling/limiting access to the area by unnecessary personnel
(3) Identifying hazards and removing and/or reducing their impact

A.11.2.3(7) The types of collapse normally encountered at an excavation or trench incident include the following:

(1) Spoil pile collapse — where the excavated earth piled on the side of the trench slides into the trench
(2) Shear wall collapse — where one side of the trench shears away from the wall of the trench
(3) Slough collapse — where a belowgrade section collapses, leaving the potential for the collapse of an overhanging ledge

The reasons and indicators of initial and secondary collapse of trenches and excavations are usually related to one or more of the following site characteristics:

(1) Unprotected trench (lack of protection systems)
(2) Static loads
(3) Standing water or water seeping into trench
(4) Intersecting trenches
(5) Vibrations (from vehicles, nearby roads, airports, etc.)
(6) Previously disturbed soil
(7) Exterior cracking of trench walls

A.11.2.3(8) Rapid, nonentry rescues include placing a ladder to allow a victim to perform a self-rescue or allowing uninjured persons in the trench to remove a victim.

A.11.2.3(9) As a rule of thumb, a cubic foot of soil weighs 100 lb, a cubic yard weighs 1.5 tons, and a cubic meter weighs 1600 kg. The weight and movement of soil alone can cause crush injuries, and the characteristics of the soil (e.g., wet, hard, sandy) will dictate how the soil will entrap (e.g., flow around, drown) a victim.

A.11.2.3(11) The primary method of risk management at this level is always to reduce the number of responders who approach the trench to only those necessary to perform the required tasks of assessing conditions in the excavation, locating a potential victim, and making any provisions to support immediate self-rescue or nonentry rescue. Other methods could include a path of approach that minimizes additional imposed load, which is typically from the end of the trench, and the use of load distribution and transfer techniques. Load transfer and distribution techniques might include the use of bridging, which uses ground ladders or lumber laid on the ground across the trench or along the edge to distribute the weight of responders and equipment across as wide an area and as far back from the lip as possible.

A.11.3.3 Severe environmental conditions include operations involving frozen soil, running soil (e.g., gravel, sand, liquid), severe weather (e.g., heavy rain, wind, or flooding), or night (dark) operations. Supplemental sheeting and shoring includes operations that involve the use of commercial sheeting/shoring systems and/or isolation devices, or cutting and placement of sheeting and shoring when greater than 2 ft (0.6 m) of shoring exists below the bottom of the strongback. Supplemental sheeting and shoring requires additional training beyond that of traditional sheeting and shoring. Traditional sheeting and shoring involves the use of 4 ft × 8 ft (1.2 m × 2.4 m) sheet panels with a strongback attachment supplemented by a variety of conventional shoring options such as hydraulic, pneumatic, and/or screw shores.

Commercial sheeting/shoring systems and devices include trench boxes, sheet piles, plate steel, and the like. Isolation devices include concrete pipes, concrete vaults, steel pipe, or anything that serves to separate the victim(s) from the surrounding soil.

A.11.3.4(1) The size-up should include, but not be limited to, the initial and continuous evaluation of the following:

(1) Scope, magnitude, and nature of the incident
(2) Location and number of victims
(3) Risk/benefit analysis (body recovery versus rescue)
(4) Exposure to traffic and sources of vibration
(5) Hazards such as disrupted or exposed utilities, standing or flowing water, secondary collapse, mechanical hazards, hazmat, and explosives
(6) Trench/excavation dimensions
(7) Access to the scene
(8) Environmental factors
(9) Available/necessary resources

A.11.3.4(5) Where the stability of adjoining buildings, walls, or other structures is endangered by excavation operations, support systems such as shoring, bracing, or underpinning should be provided to ensure the stability of such structures for the protection of employees. Excavation below the level of the base or footing of any foundation or retaining wall that could be reasonably expected to pose a hazard to employees should not be permitted except when one of the following occurs:

(1) A support system, such as underpinning, is provided to ensure the safety of employees and the stability of the structure.
(2) The excavation is in stable rock.
(3) A registered professional engineer has approved the determination that the structure is sufficiently removed from the excavation so as to be unaffected by the excavation activity.
(4) A registered professional engineer has approved the determination that such excavation work will not pose a hazard to employees. Sidewalks, pavements, and appurtenant structures should not be undermined unless a support system or another method of protection is provided to protect employees from the possible collapse of such structures.

A.11.3.4(6) Procedures to identify probable victim locations include the following:

(1) Visualization of the victim
(2) Presence of drink cups or food containers, work tools, laser targets, buckets, grade poles, grease and brush, engineers' hubs, or anything that can indicate the victim's last probable physical location
(3) Information from bystanders
(4) End of pipe string
(5) Sounds in pipes
(6) "Cat" or tire tracks

A.11.3.4(7) In many parts of the United States, a one-call underground utility location service is available to contractors and residents who are preparing to excavate. By making one telephone call (usually a toll-free number), excavators can learn the location of all underground utility installations in the area of the planned excavation. This service quickly notifies all possible utility providers in the area who, in turn, either indicate that there is no utility in the area or have someone go to the site to mark the utilities. Such a service can be invaluable to emergency responders at the site of a trench or excavation emergency incident.

Where no one-call system exists, all utility companies that might have underground equipment at or near the excavation site must be notified so they can have a representative respond to mark underground utility locations.

A.11.3.4(8) See Annex H.

A.11.3.4(11) These methods are intended to allow rescuers to work at or near the edge of the excavation without substantially increasing loads at the lip of the trench. Some broad categories of accomplishing this include the following:

(1) Distribution: Typically accomplished through the use of ground pads or similar methods to distribute the imposed weight of the rescuers across a wider area. These methods are quick and relatively easy to deploy but they do not completely eliminate additional surcharge at the lip and will typically require rescuers to approach the edge to implement them, often requiring them to move the spoil pile for their placement. In addition, they obscure the ground adjacent to the trench, preventing rescuers from monitoring ground movement.
(2) Transmission: Usually accomplished through bridging the trench with ladders or lumber, these methods are intended to transmit the additional loads of the rescue effort outside the zone where they could influence soil forces inside the trench. While they will reduce or eliminate the increase in imposed weight at the edge, they require additional resources for coordination for implementation and the physical space to deploy the bridging.
(3) Reduction: This is quite simply the elimination of nonessential resources from the area of influence and minimizing potential loading at the lip.

In general, most trench environments will require the use of more than one of these techniques. In some cases these techniques might be implemented concurrently to accommodate the geography around the trench and sequentially in others as the incident matures and conditions change and additional resources become available.

A.11.3.4(12) A ladder or engineered ramp can be required for entry or egress from a trench. For instance, 29 CFR 1926.651(c)(1)(v) requires, "A stairway, ladder, ramp or other safe means of egress shall be located in trench excavations that are 4 feet or more in depth so as to require no more than 25 feet of lateral travel for employees."

A.11.3.4(13) The rescue area is that area immediately surrounding the trench and/or excavation site. Making the rescue area safe includes, but is not limited to, the following actions (however, specific actions should be based on both the type of collapse and the soil type):

(1) Using sheeting and shoring to stabilize trench/excavation walls
(2) Making the trench/excavation safe for entry
(3) Safely undertaking disentanglement operations in the trench/excavation
(4) Placing ground pads at the lip of the trench/excavation
(5) Ventilating the trench and monitoring its atmosphere
(6) Dewatering
(7) Supporting any unbroken utilities
(8) Providing a helmet and goggles for a victim, if possible
(9) Prohibiting entry into an unsafe trench/excavation
(10) Preventing the touching or operating of heavy equipment until its safety has been established

The term *tabulated data* usually refers to the six tables found in Appendix C of 29 CFR 1926, Subpart P.

Traditional sheeting and shoring should not be used in situations that exceed the tabulated data for timber trench shoring presented in 29 CFR 1926, Subpart P. Also, these systems should not be used where they would be submerged in water.

A.11.3.4(14) The pre-entry briefing should include, but not be limited to, information regarding the following:

(1) Tactical assignments with explicit instructions
(2) General hazards and safety instructions
(3) Communications protocols, procedures, and details
(4) Anticipated environmental concerns
(5) Time frames for operations
(6) Emergency procedures
(7) Specific equipment needs
(8) Debriefing procedures
(9) Anticipated logistical needs

A.11.3.4(15) Documentation for entry operations, as a minimum, should include the following:

(1) Development of some type of representation of IMS command structure
(2) Time of incident
(3) Total time of operation
(4) Environmental conditions
(5) Location of victim
(6) Creation of a tactical checklist that includes entry times, exit times, personal accountability reports, atmospheric readings, rehabilitation information, injuries sustained, and incident number

A.11.3.4(17) See Annex B for information on sloping and benching systems.

A.11.3.4(20) Procedures for disentanglement and removing the entrapment mechanism can include, but are not limited to, the following:

(1) Hand digging
(2) Lifting using air bags, pneumatic, or other mechanical advantage devices

(3) Suctioning
(4) Cutting using air knives, saws, or other power tools
(5) Dewatering
(6) Use of heavy equipment

Procedures and equipment involved in removal systems should comply with the applicable portions of this standard.

Heavy or mechanical equipment and/or mechanical winches of any kind should not be used to physically lift, pull, or extricate victims from a trench. However, there can be circumstances when heavy equipment can be appropriate for accessing victims of trench and evacuation emergencies with the appropriate level of supervision and after careful consideration is given to the negative impact of such actions on the victim, including the effects of extreme superimposed loads and vibration adjacent to the trench. For example, heavy equipment might be used to dig an adjacent trench or hole for access, but the excessive loading and vibration of the area adjacent to the trench can cause a rapid deterioration in the condition of, and in the immediate environment surrounding, the victim. In any case, to best establish viable options and available capabilities, the advice of experienced and knowledgeable onsite personnel should be sought in order to make the best possible decisions.

A.11.4.2 See A.11.3.3.

A.11.4.3(3) Conventional panel shoring systems constructed in compliance with recognized tabulated data provides the greatest margin of safety in the widest range of soil conditions. Its method of construction and assembly also provides the most predictably reproducible results across the broadest range of expertise of responders. However, in some cases the contours of the trench might not permit adequate soil contact between a panel and the wall of the trench to ensure the panel system reacts predictably in a manner consistent with its design when exposed to the forces exerted by the soil. In some instances, this can be resolved through backfilling the area behind the panel or through the use of supplemental shoring to transfer the load between the soil and an installed panel shore system. In other cases, nonstandard methods such as the installation of single- point shores independent of a panel shore system could successfully prevent unwanted soil movement long enough to perform a rescue. It is important to recognize that methods such as these will likely fall outside the parameters of the tabulated data used by the construction industry. By their nature these techniques have inherent additional risks as they rely on soil characteristics that are difficult to objectively assess in the field and should only be assessed by a competent person. As a result, these techniques might incur additional risk of soil collapse if not installed properly or if the rescuer does not understand how these methods rely on internal soils mechanics for their success. Specific additional training on the implementation, applicability, and construction of alternative shoring systems is required to ensure that the soil forces and movements are resolved and/or balanced to reduce the potential for additional trench collapse.

A.11.4.3(9) Manufactured protection systems include trench boxes, rabbit boxes, "coffins," rigging and placement of sheet piles, rigging and placement of plate steel, or other similar commercial systems. *[See also 11.3.4(6).]*

A.11.4.3(10) Personnel meeting the requirements of NFPA 470 should perform the monitoring procedures even if such personnel are not part of the rescue team. Important information regarding these procedures include, but are not limited to, the following:

(1) Acceptable limits for oxygen concentration in air should be between 19.5 percent and 23.5 percent. An oxygen-enriched atmosphere is considered to be greater than 23.5 percent and poses a flammability hazard. An oxygen-deficient atmosphere is considered to be lower than 19.5 percent and can lead to asphyxiation without fresh-air breathing apparatus.
(2) Flammability is measured as a percentage of a material's lower explosive limit (LEL) or lower flammable limit (LFL). Rescuers should not enter confined spaces containing atmospheres greater than 10 percent of a material's LEL regardless of the PPE worn. There is no adequate protection for an explosion within a confined space.
(3) Acceptable toxicity levels are specific to the hazardous material involved, and chemical properties should be assessed to determine the level of the hazard for a given environment and time frame.

A.11.4.3(13) In certain soil and environmental conditions, it can be necessary to isolate the victim to disentangle him or her effectively. For instance, in sand, grain, pea gravel, coal slag, or any type of running product, it can be necessary to isolate the victim physically from the surrounding product to free him or her. Examples of isolation devices include concrete or steel pipe, corrugated pipe, concrete vaults, or other pre-engineered structures that sufficiently isolate and protect the victim.

A.11.4.3(16) The use of alternative shoring or support methods must be compatible with the soil and failure conditions and requires the understanding and application of engineering principles. The pressures acting on and resulting from alternative shoring systems are significantly increased when the structural elements of conventional shoring systems (e.g., strongbacks and panels) are not used.

A.12.2.3(1) The size-up should include, but not be limited to, the initial and continuous evaluation of the following:

(1) Scope and magnitude of the incident
(2) Risk/benefit analysis (body recovery versus rescue)
(3) Size, construction, and material of machines affected
(4) Integrity and stability of machines affected
(5) Number of known potential victims
(6) Access to the scene
(7) Hazards such as disrupted or exposed utilities, standing or flowing water, mechanical hazards, hazardous materials, electrical hazards, and fire and explosives
(8) Exposure to traffic
(9) Environmental factors
(10) Available versus necessary resources

A.12.2.3(2) It is the intent of this provision that the AHJ, as part of the hazard identification and risk assessment, identify the types of machinery within its response area. These types can include, but are not limited to, agriculture implements, industrial/construction or process machinery, and elevators/escalators. The AHJ should develop procedures and provide training to personnel that is commensurate with the potential for search and rescue situations involving the above-mentioned machinery.

A.12.2.3(3) See A.4.2.6.

A.12.2.3(4) The emergency response system includes, but is not limited to, operations- and technician-level organizations capable of responding to various types of search and rescue incidents, as well as local, state, and national resources.

A.12.2.3(5) These procedures should include the process of achieving and maintaining control of the site and the perimeter. They might include management of all civilian and nonemergency personnel and establishment of operational zones and site security.

A.12.2.3(6) General hazards associated with operations at machinery search and rescue incidents can present the AHJ with uniquely challenging situations. The AHJ should consider the following potential hazards when providing training to its members:

(1) *Utilities.* Control of the utilities in and around a machinery search and rescue incident is critical to ensure the safety of responding personnel and victims. The AHJ should provide its members with training in the control of these services to provide a safe environment in which to operate and to ensure the safety of victims. The following utilities should be considered when providing training:
   (a) Electrical services (primary and secondary)
   (b) Gas, propane, fuel oil, or other alternative energy sources (primary systems)
   (c) Water
   (d) Sanitary systems
   (e) Communications
   (f) Secondary service systems (such as compressed, medical, or industrial gases)

(2) *Hazardous Materials.* Machinery rescue incidents might include various materials that, when released during an incident, could pose a hazard to victims and responders. The AHJ should provide members with training in the recognition of potential hazardous material releases, the determination of an existing hazard, and the methods used to contain, confine, or divert hazardous materials to conduct operations safely and effectively.

(3) *Personal Hazards.* At the site of any machinery search and rescue incident, there are many dangers that pose personal injury hazards to the responders. The AHJ should train members to recognize the personal hazards they encounter and to use the methods needed to mitigate these hazards to help ensure member's safety. Every member should be made aware of hazards such as trips, falls, blows, cuts, abrasions, punctures, impalement, and so forth.

(4) *Movement of Machinery.* Uncontrolled movement of machinery components can cause extremely hazardous and potentially fatal situations. Responding personnel should be familiar with and trained in techniques for stabilizing and removing the potential for movement of machinery components.

(5) *Release of High-Pressure Systems.* Machinery often includes high-pressure systems (e.g., hydraulic, pneumatic) that can fail without warning. Such failure can cause extremely hazardous conditions, injury, and death of victims and responders. The AHJ should provide members with training in the recognition of potential high-pressure system hazards, the determination of an existing hazard, and the methods used to contain, confine, or divert such hazards to conduct operations safely and effectively.

(6) *Other Hazards.* There are numerous other hazards associated with machinery search and rescue incidents. The AHJ should make every effort to identify the hazards that might be encountered within the jurisdiction and should provide members with training and awareness of these other hazards to allow them to perform search and rescue operations safely and effectively.

A.12.2.3(7) Support operations can include, but are not limited to, the following functional sectors in the incident management system:

(1) *Ventilation Group.* Monitors and ventilates personnel
(2) *Extrication Group.* Prepares for extrication methods and tactics
(3) *EMS Group.* Plans for ongoing patient care, transfer, and transport in coordination with the incident commander and receiving hospital
(4) *Support Group.* Can handle lighting, power, and environmental management
(5) *Cut Station.* Handles construction and fabrication of shoring materials

A.12.3.4(1) The size-up should include, but not be limited to, the initial and continuous evaluation of the following:

(1) Scope and magnitude of the incident
(2) Risk/benefit analysis (body recovery versus rescue)
(3) Size, construction, and material of machines affected
(4) Integrity and stability of machines affected
(5) Number of known or potential victims
(6) Access to the scene
(7) Hazards such as disrupted or exposed utilities, standing or flowing water, mechanical hazards, hazardous materials, electrical hazards, and fire and explosives
(8) Exposure to traffic
(9) Environmental factors
(10) Available versus necessary resources

A.12.3.4(3) The search and rescue area is that area immediately surrounding [within a 20 ft (6.10 m), or so, radius of] the machinery. Making the search and rescue area safe includes, but is not limited to, the following actions; however, specific actions should be based on the machinery type and specific situation:

(1) Establishing operational zones (i.e., hot, warm, cold) and site security
(2) Using specific techniques and tools (including cribbing, chocks, and wedges) to stabilize the machinery
(3) Using specific techniques and tools (i.e., lockout, tagout, control zones) to isolate the involved equipment
(4) Making the search and rescue area (i.e., hot zone) safe for entry
(5) Safely undertaking disentanglement and extrication operations
(6) Ventilating the search and rescue area and monitoring its atmosphere when necessary
(7) Supporting any unbroken utilities
(8) Providing protective equipment for any victims, if possible, when necessary
(9) Prohibiting entry into an unsafe vehicle or machinery search and rescue area
(10) Preventing the touching or operating of equipment or machinery involved until its safety has been established

A.12.3.4(4) The use of nonsparking tools should be considered where a flammable atmosphere exists.

A.12.3.4(8) To ensure a safe disentanglement or extrication operation, the AHJ should provide training on the following topics:

(1) Weight estimation
(2) Construction and materials of small machinery
(3) Identification of tension and compression forces
(4) Pneumatic high-, medium-, and low-pressure lifting bags
(5) Categories of mechanical injury
(6) Various ground-based stabilization techniques
(7) Center of gravity and its relationship to rollover
(8) Use of cribbing, chocks, and box cribbing
(9) Proper use of shackles and slings (including wire rope, chain, and synthetic rope of various types and styles)
(10) Types and examples of levers for mechanical advantage
(11) Proper and effective use of hand tools including a hammer, wrenches, sockets, screwdrivers, pry bars, saws, cable cutter, jacks, and come-along
(12) Disentanglement through primary access points
(13) Patient packaging prior to removal from a machine
(14) Protection of the victim during extrication or disentanglement operations
(15) Proper and effective use of power tools such as hydraulic, pneumatic, and electrical spreading, cutting, lifting, and ram-type tools
(16) Lockout/tagout of machinery
(17) Identification and use of various sling configurations
(18) The steps to lift and/or move an object

A.12.3.4(9) These procedures refer to the mitigation and management of the hazards identified in A.12.2.3(6).

A.12.3.4(11) Identifying the type of elevator systems found in buildings and determining the type of mechanical movement and the mechanical components can aid in minimizing the time required to extricate a conceivably trapped or entangle victim(s) from these devices.

A.12.3.4(12) The committee recognizes that technical rescue incidents pose unique challenges in terms of safely concluding or demobilizing an event. The sequence and manner in which resources are transitioned out of an event require careful analysis to ensure that scene and rescuer safety are not compromised. Risk management strategies can include both active and nonintervention strategies, such as not removing (i.e., abandoning in place) equipment, denying entry to a site, and so forth. A large number of catastrophic events have occurred during the end or termination stages of such events when personnel are fatigued and resources are in a state of transition from active event participation to a return to service.

A.12.4.3 Refer to the definition for large machine in NFPA 1006.

A.12.4.4(2) To ensure that disentanglement or extrication from large machines is performed safely, in addition to those topics listed in A.12.3.4(1)(8) the AHJ should provide training on the following topics:

(1) Use of commercial heavy wreckers or crane services to assist at incidents involving large machinery
(2) Use, care, and maintenance of power winches
(3) Disentanglement through both primary and secondary access points through the use of available power tools

A.12.4.4(3) "Advanced stabilization" in this context includes the use of either of the following techniques on a machine of any size that has a shape or center of gravity that causes it to be inherently unstable:

(1) Use of commercial heavy wreckers or crane services to assist at incidents involving large machinery
(2) Use, care, and maintenance of power winches
(3) Establishment of an anchor over one's head
(4) Shoring

The intent here is to suggest that advanced stabilization is beyond the operations level and requires the tools and techniques of a technician-level team.

A.12.4.4(4) Power tools (e.g., air bags, hydraulic spreaders and rams, hand tools, and other power tools) and training necessary to remove, cut, and move components displaced at a machinery search and rescue incident should be provided. "Specialized rescue equipment" can include, but is not limited to, hydraulic, pneumatic, and electrical spreading, cutting, lifting, and ram-type tools immediately available and in use by the organization.

A.12.4.4(5) In elevator rescues, the typical safe order of victim removal is as follows:

(1) Car at or near the landing [(within 18 in. (457 mm)], floor level through the normal entranceway
(2) Car within 3 ft (914.4 mm) of the landing, floor above through the normal entranceway
(3) Car stalled more than 3 ft (914.4 mm) from the landing (stalled above the landing), floor below through the normal entranceway (barricade opening to shaft)
(4) Car stalled more than 3 ft (914.4 mm) from the landing (top escape hatch removal), top escape hatch (must use fall arrest system)

A.12.4.5 This procedure will eliminate the hazard of a moving elevator and remove potential of a falling hazard. Adjacent elevator(s) in excess of five (5) floors might have large counterweights operating in the rear portion of the hoistway. Securing these remaining elevator(s) can aid in removing a potential source of energy that travels the opposite direction of the intended direction of the car.

A.12.4.6 Lockout/tagout procedures should be initiated including confirmation that all power sources have been secured in the off position.

A.13.2.3(2) Conventional emergency response PPE and other equipment (especially fire-related equipment) are often inappropriate for use in a cave setting. For instance, fire helmets and boots can increase one's potential for injury in the cave. Conventional emergency response skills such as using a sphygmomanometer and using an ambulance cot have very little application in the cave. Therefore, such skills and equipment will require modification to achieve the rescuer's desired goals in the cave. Caving is not simply confined space rescue on rope or in the dark. Typical travel times can be hours or even days to reach remote sections of caves. Rescuers should carry their own light with power source and spares, food, and other needs and be totally self-sufficient for at least 12 to 24 hours depending on the cave involved.

A.13.2.3(3) Organizations at the awareness and operational levels of cave search and rescue, that have caves in their operational area, should have a plan for contacting appropriate resources for cave rescue incidents. The National Cave Rescue Commission (NCRC) of the National Speleological Society provides a resource list of organizations with cave rescue capa-

bilities, local caches of specialized cave rescue equipment, and local caving organizations. The NCRC provides training to both organizations and individuals in cave rescue.

A.13.2.3(5) General hazards associated with search and rescue operations in the cave can present the AHJ with uniquely challenging situations. The AHJ should consider the following potential hazards and, to help provide for their safety, ensure that members have the ability to recognize potential hazards that they could encounter. As many caves can be a mile or more from roadways, access to the cave entrance will bring the cave rescuer into many of the hazards also present in a wilderness response. In addition to those hazards, the following hazards will be encountered in-cave.

(1) *Personal Hazards.* In the cave environment, there are many dangers that pose personal injury and physiological hazards to responders. Personnel should be made aware of such hazards, including, but not limited to, blisters, scrapes, scratches, falls, blows, bruises, dehydration, and so forth.
(2) *Environmental Hazards.* Depending on the specific environment, there are many dangers that pose hazards to responders. Personnel should be made aware of such hazards, including, but not limited to, cold, chilling winds, water, exposure injuries (cold and heat), toxic plants, infectious organisms, and hazardous animal life.
(3) *Terrain Hazards.* Specific features in an environment can pose hazards to responders. Personnel should be made aware of such hazards, including, but not limited to, pits, sumps, waterfalls, standing water (e.g., ponds, lakes), moving water (e.g., rivers, streams), and so forth.
(4) *Man-Made Hazards.* Humans, whether intentionally or accidentally, can also cause unsafe conditions in the cave. Personnel should be made aware of such hazards, including, but not limited to, booby-trapped stills, labs (e.g., covert ethanol, drugs), gates, ladders, and inappropriate rigging.

A.13.2.3(6) One of the most important tasks for the first on-scene responders is to establish control of all cave entrances. A log should immediately be started and anyone leaving or entering the cave via any entrance should be logged in or out and details as to their assignment and the equipment they are carrying in should be logged as well.

A.13.2.3(7) Documents for the collection and recording of information can include the following:

(1) Information regarding the lost person(s)
(2) Entrance(s) control logs
(3) Information needed to determine search urgency
(4) Information required by the AHJ
(5) Information required by the incident management system (IMS)
(6) Information required to identify a subject's track (i.e., footprint)
(7) Information for development of search strategy

A.13.2.3(8) Isolation includes keeping the reporting party readily available for interviewers and isolated from media and the incident operations, as well as isolated from one another, in the case of multiple reporting parties.

A.13.3.2.1 In some cases, where minimum exposure to cave hazards exists, it can be appropriate for the AHJ to establish SOPs that permit an operations-level organization to conduct certain search and rescue operations without supervision of a technician-level organization. As a minimum, the members of the operations-level organization entering the cave should have the following:

(1) Proficiency in crawling, climbing, and moving over uneven surfaces and breakdown areas covered in mud, sand, or water
(2) Familiarity with chimneying, bridging, and other basic climbing techniques used in moving through caves
(3) Ability to move comfortably and efficiently in small spaces
(4) Ability to carry personal equipment and rescue equipment through the cave
(5) Ability to identify fragile cave environments and take measures to protect them
(6) Ability to maintain primary light sources
(7) Ability to be self-sufficient underground for 24 hours
(8) Ability to read cave maps and the special symbols associated with them
(9) Ability at both rappelling and ascending drops of 100 ft (30.48 m) or more, often in free fall
(10) Ability to change over from rappel to climbing and climbing to rappel in adverse situations such as complete darkness and in waterfalls
(11) Ability to pass a knot on rappel or ascent
(12) Ability to pass a re-belay point in-cave

A.13.3.3(1) The size-up should include, but not be limited to, the initial and continuous evaluation of the following:

(1) Scope and magnitude of the incident, including whether it is a search, rescue, or body recovery
(2) Assessment of time required
(3) Assessment of staffing needs
(4) Specific environmental factors involved
(5) Integrity and stability of the environment involved
(6) Number of known/potential victims
(7) Weather (current and forecast)
(8) Time to locate patient at unknown location in cave
(9) Difficulty of real-time communication flow underground
(10) Travel time to know patient location
(11) Transport time of patient(s) in restricted cave passage
(12) Vertical rigging challenges
(13) Logistical issues with rotation of rescuers and/or resupply and rehabilitation of rescuers in place underground

A.13.3.3(2) See A.13.2.3(3).

A.13.3.3(3) Organizations should have access to a basic understanding of the cave environment, including their regional differences in ambient cave temperature, normal hazards such as risk of hypothermia, and risk of potential changes in cave environment due to seasonal variations and outside weather.

A.13.3.3(4) Organizations should have special knowledge and equipment for medical treatment and patient transport specific to cave rescue, which can include the following:

(1) Familiarity with use of vapor barriers for in-cave patient protection from wind and water
(2) Familiarity with confined space drag sheet–type patient transport devices (such as the SKED® and Half-SKED®), spinal immobilization devices with built-in patient lift harness (for evacuation purposes), solid basket litters, and ability to identify litters appropriate for small spaces
(3) Practical experience in moving litters through long, narrow, uneven spaces

A.13.3.3(6) Personal support equipment should include that which is necessary to address the following needs, or potential needs, of a rescuer in a cave setting:

(1) Three sources of light, helmet mountable and capable of allowing the rescuer to enter the cave
(2) Personal medical (first aid) supplies
(3) Additional clothing appropriate for anticipated environment/weather
(4) Fluids and food appropriate for mission duration
(5) Personal safety and comfort gear [e.g., insulated pads for sitting on, shelter, body waste management container(s)]
(6) Navigation tools (e.g., compass, map)
(7) General marking and documentation tools (e.g., flagging tape, paper/pencil)
(8) Improvisational tools (e.g., wire, twine, leaf bag, safety pin)
(9) Emergency shelter, bivouac, and/or body protection
(10) Emergency communications (e.g., whistle, glow stick, candle)
(11) Cave-suitable pack for contents

A.13.3.3(7) The AHJ should establish procedures for negotiating and/or avoiding conditions and hazards specific to the cave environments and terrains in which rescuers can become involved. It is likely that some conditions and/or situations will exceed the capability of the organization. In such situations, additional, more experienced, specialized, or highly trained resources should be procured. It is possible that rescuers will have more than 6 hours travel time inside a cave that requires confined space, swift water, and vertical rope ascending and descending skills just to reach an injured patient in a cave. Having a pre-incident working relationship with local cavers who have been trained in cave rescue skills is an excellent way to augment the AHJ's cave rescue response. The National Cave Rescue Commission of the National Speleological Society provides training specific to the cave environment for both cavers and professional rescue resources.

A.13.3.3(13) Caves are often direct drainage for rainwater falling in the immediate area and in some cases from miles away. Weather forecast and local knowledge of drainage patterns should be used to prevent rescuers from being caught in or trapped by rising water.

A.13.3.3(14) Skills involved in supporting and participating in a search should include, but not be limited to, the following:

(1) Hasty, efficient, and thorough search techniques
(2) Principles of confinement of the search area
(3) Principles and importance of clue awareness
(4) Basic search theory application and terminology
(5) Principles of lost person behavior
(6) Procedures for serving as an air observer (e.g., searching from an aircraft)
(7) Procedures for handling, processing, and documenting evidence

A.13.3.3(17) The ability to discern limitations in accessing and/or evacuating should be based on the following:

(1) Individual and team expertise
(2) Qualified personnel available
(3) Ability to communicate from the patient scene
(4) Anticipated staffing and time

A.13.3.3(21) The organization should have the ability to establish communication system(s) appropriate for the cave environment and distance from incident command, including the following:

(1) Access to and ability to install wired communications
(2) Ability to operate field telephones
(3) Access to and ability to operate low-frequency cave radios
(4) Message runners if the above are not available

A.13.4.5 Cave search and rescue organizations at the technician level are not required to develop and maintain capabilities in all types of cave search and rescue operations [e.g., flooded or underwater caves, cave diving and recovery, and vertical over 200 ft (60.95 m)].

A.13.4.6(4) Members of an organization at the technician level should be adept and experienced at every skill required of subordinate personnel. Technician-level organizations should have the capability to address any potential operation that falls within their jurisdiction. To accomplish this, members of these organizations should be personally adept at cave skills, travel, and operations in the cave setting.

A.13.4.6(5) Such an operational plan should be based on the hazard identification and risk assessment performed according to Section 4.2, available resources, environmental influences and conditions, and the urgency of the situation. Specifically with regard to a search, the implemented plan should involve planning and search management techniques, including, but not necessarily limited to, the following:

(1) Determining the urgency of the search
(2) Developing a lost subject profile
(3) Establishing the search area and correctly dividing it into regions and segments as necessary
(4) Conducting an appropriate investigation and interviews
(5) Applying the mathematical concept of probability and search theory
(6) Designing, developing, and establishing appropriate search strategy and tactics
(7) Establishing and managing appropriate base camp
(8) Briefing and debriefing of operational personnel properly and thoroughly
(9) Considering suspension of the search when appropriate
(10) Demobilizing personnel and facilities
(11) Documenting the incident properly

A.14.1.2 Procedures for active underground structures and excavations are well covered by existing standards and regulations such as those of the Mine Safety and Health Administration (MSHA). In addition, existing regulations and standards address general operations in underground structures such as subway stations, road tunnels, and parking garages. This chapter is intended to address the requirements of search and rescue operations in and around inactive or abandoned underground structures and excavations, sometimes when the safety systems addressed by other standards and regulations have been compromised. “Search and rescue” in this context does not include fire-fighting operations in general, which are also covered by other standards and regulations.

Surface mines such as quarries and open pits are outside the scope of this chapter.

A.14.1.2.2 Generally, underground structures and excavations do not qualify as permit-required confined spaces such as those addressed in 29 CFR 1910.146 and/or equivalent local regula-

tions, due to the long distances and other unique characteristics. However, tunnels or mines could have equipment, spaces, or areas that do meet the criteria for confined spaces. It is not the intent to exclude those areas from the requirements of other chapters in this document.

A.14.1.3 In the United States, the Department of Labor's Mine Safety and Health Administration (MSHA) has established regulations for mine rescue teams at operating mines. Tunnels under construction are regulated by the Occupational Safety and Health Administration (OSHA) or by equivalent state agencies.

A.14.1.3.2 The requirements of this section should be confirmed by an annual evaluation of the search and rescue organization's capabilities to perform mine and tunnel rescues in terms of overall timeliness, training, and equipment and to perform safe and effective search and rescue in those types of situations to which the team must respond.

A.14.1.3.4 Representative mines and tunnels should — with respect to opening size, configuration, and accessibility — simulate the types of mines and tunnels from which rescue is to be performed.

A.14.1.3.5 The term *timely* is based on many factors, such as perceived danger of the original entry (e.g., possible supplied breathing air required), distance to definitive medical care, capabilities of responding emergency medical services, and so forth. In trauma-related injuries, the "golden hour" principle can be used to determine how quickly the search and rescue organization should be able to respond to deliver the patient to the appropriate treatment facility within an hour of onset of injuries. The search and rescue organization should have a goal of responding to these emergencies within 15 minutes of the time they receive notification. OSHA 1926.800(g)(5) includes response time requirements for tunnel rescue teams.

A.14.1.4 U.S. federal regulations (30 CFR 49.2) require five members and one alternate for rescue teams to perform entry at working mines. The intent of the minimum staffing requirements in this document is to provide for adequate staffing to mobilize an appropriately sized entry team to perform the mission, provide for immediate rescue of team members, assist with victim packaging, and movement under long and difficult conditions. Nothing in this document is intended to mandate a minimum or maximum size of the actual entry team.

A.14.2.3(3) Hazards can include, but are not limited to, the following:

(1) Hazardous atmospheres
(2) Hazardous chemicals
(3) Temperature extremes
(4) Fall hazards
(5) Moving equipment

Some methods of recognition and assessment of hazards associated with mines and tunnels include, but are not limited to, the following:

(1) Assessment of the perimeter surrounding the mine or tunnel incident to determine the presence of or potential for a hazardous condition that could pose a risk to rescuers during approach
(2) Recognition of the need for decontamination of a patient or responder who might have been exposed to a hazardous material as per Chapter 18 of NFPA 470 and OSHA regulations in 29 CFR 1910.120, "Hazardous Waste Operations and Emergency Response" (HAZWOPER)
(3) Recognition of the need for a search and rescue organization or additional resources
(4) Notification of the designated search and rescue organization and other resources necessary for initiation of mine or tunnel rescue
(5) Recognition of hazardous atmospheres or materials through visual assessment and information received from on-site personnel
(6) Recognition of potential fall hazards in and around the site
(7) Recognition of potential hazards associated with open excavations in and around the site

A.14.2.3(4) The term *tunnel* refers to a covered excavation used for the conveyance of people or excavations that are, or will be, connected to the tunnel, including shafts and trenches.

Underground mines are a series of tunnels and shafts underground used to obtain something from the soil through which they are excavated.

Tunnels and mines differ from each other in that in the construction of a tunnel the final product is the hole in the earth and the removed soil is a by-product of that process, while in mining, the tunnel is a by-product of the process of removing the soil.

A.14.2.3(5) The emergency response system includes, but is not limited to, operations- and technician-level organizations capable of responding to various types of search and rescue incidents, as well as local, state, and national resources. In addition, the system includes procurement of on-site information resources such as witnesses, entry supervisors, facility managers, engineers, or other responsible persons. Common formal information sources can include, but are not limited to, the following:

(1) Accountability system — which may be a "brass board," sign-in log, or other means of personnel accountability
(2) Chemical information documents (i.e., SDS)
(3) Other site work permits
(4) Shift log or tie-over book
(5) Emergency response plan
(6) Mine maps (older abandoned mines might not have maps readily available, although local Mine Safety and Health inspectors might have these records archived from when the mine was active)
(7) Engineering drawings

A.14.2.3(6) These procedures should include the process of achieving and maintaining control of the site and the perimeter. This process might include management of all civilian and nonemergency personnel and establishment of operational zones and site security. The organization should also ensure through written standard operating guidelines that the scene is rendered safe at the termination of the incident.

A.14.3.3(1) The assessment at this level should include, but not be limited to, the initial and continuous evaluation of the following:

(1) Hazards such as engulfment potential, environmental hazards (e.g., chemical, atmospheric, temperature), harmful forms of energy (e.g., electrical, mechanical, movement due to gravity, hydraulic), configuration

hazards (e.g., diverging walls, entrapment, obstructions, trip/fall hazards), and so forth
(2) Risk/benefit analysis (body recovery versus rescue)
(3) Available and necessary additional resources
(4) Establishment of control zones
(5) Magnitude of the hazard and isolation procedures
(6) Effectiveness of the non-entry or qualifying entry–type rescue
(7) Overall safety of search and rescue operations
(8) Level of search and rescue response (appropriate for the type of operations being attempted)
(9) Current and projected status of the planned response
(10) Personnel accountability

A site safety plan can also provide useful information for consideration during size-up and should include the following:

(1) Search and rescue team notification
(2) Acceptable entry conditions for rescue
(3) Hazard identification
(4) Risk assessment of hazards
(5) Site map
(6) Hazard abatement (including control zones, ventilation, and lockout/tagout procedures)
(7) Use of buddy system (where applicable)
(8) Communications (e.g., site, rescue attendant to rescue entrant)
(9) Command post
(10) Incident management organizational chart
(11) Standard operating guidelines
(12) Safe work practices
(13) Medical assistance
(14) Pre-entry safety briefings
(15) Pre- and postentry physicals (if indicated)

A.14.3.3(2) The AHJ should address the possibility of members of the organization having physical and/or psychological disorders (e.g., physical disabilities, fear of heights, fear of enclosed spaces) that could impair their ability to perform in mines or tunnels.

A.14.3.3(3) Roles, functions, and responsibilities for these team positions should be consistent with the organization's standard operating guidelines for mine and tunnel rescues.

A.14.3.3(4) See A.7.3.7(5).

A.14.3.3(5) The requirement for emergency egress respiratory protection can be satisfied with a self-contained self-rescuer device designed and approved for use in a mine or tunnel environment, such as those meeting the requirements of MSHA/NIOSH.

A.14.3.3(6) The intent of this item is to restrict entries made by operations-level organizations to those that would absolutely minimize risk to rescue entrants. It is the intent of this document that operations-level teams not perform hazardous entries.

A.14.3.3(6)(i) The intent of this item is to allow for easier retrieval of rescue entrants should this become necessary and to provide for passage through the opening without removal of necessary PPE, including fresh air breathing apparatus.

A.14.3.3(6)(j) The intent of this item is to allow a "buddy system" to be employed, providing potentially faster response to a problem with one of the rescue entrants.

A.14.3.3(6)(k) The intent of this requirement is to ensure that hazards to rescuers in organizations at this level are kept to an absolute minimum.

A.14.3.3(7) "Packaging devices" that can be used in mines and tunnels include, but are not limited to, the following:

(1) Full spine immobilization devices
(2) Short spine immobilization devices
(3) Cervical spine immobilization devices
(4) Litters
(5) Prefabricated full-body harnesses
(6) Tied full-body harnesses
(7) Wrist loops (wristlets)

A.14.3.3(10) Organizations at the operations level are expected to safely apply lowering and raising systems (rope- or non-rope based) as appropriate during mine or tunnel emergencies. These applications can involve the use of rope rescue systems in the high-angle environment both to lower rescuers into and to remove rescuers and victims from mines and tunnels. The determination of what systems are most appropriate to accomplish these tasks should be dictated by the circumstances surrounding the incident.

A.14.4.3 While five people are the recommended minimum for most entry-type mine and tunnel rescue operations, some such rescues will require more or fewer rescuers. The number of personnel required should be determined by the situation, hazards, and degree of difficulty of the situation confronted. A team is "qualified" by its capability as a team, not by the individual qualifications of its members.

A.14.4.3.1 Depending on the size of the space, its configuration, and associated travel distances, it might be more beneficial to have all or a portion of the backup team positioned inside the space at a fresh air base or forward staging area.

A.14.4.3.3 The requirement for emergency egress respiratory protection can be satisfied with a self-contained self-rescuer device designed and approved for use in a mine or tunnel environment, such as those meeting the requirement of MSHA/NIOSH.

A.14.4.3.5 Tunnels under construction in particular have specific action levels for certain contaminants, such as methane, which might vary from more conventional action levels for atmospheric hazards.

A.14.4.3.6 "Verbal" in this context means any method of conveying voice messages from one person to another, including direct speech and electronic technology.

A.14.4.3.8 The requirement of this section can be met by having each entry team member wear an MSHA/NIOSH-approved oxygen generating self-rescuer.

A.14.4.4(6) The size-up/assessment at this level should include, but not be limited to, the initial and continuous evaluation of the following:

(1) Available and necessary additional resources
(2) Hazard isolation and control requirements

A.14.4.4(7) Procedures should be consistent with local, state, and federal guidelines, such as those found in 29 CFR 1910.120, "Hazardous Waste Operations and Emergency Response" (HAZWOPER).

A.14.4.4(8) See Annex G.

A.14.4.4(9) The health and safety regulations regarding the construction of tunnels apply to all. See 3.3.158 for the definition of tunnel. Also see Annex G.

A.15.1.2 One intent of this chapter is to distinguish between three levels of capability for organizations using helicopters at search and rescue operations. Organizations at the awareness level are capable of recognizing hazards, using PPE, and implementing techniques necessary to operate in the vicinity of the helicopter. Organizations at the operations level are capable of recognizing hazards, using PPE, and implementing techniques necessary to operate in a support function inside and immediately outside of a helicopter. Organizations at the technician level are capable of recognizing and mitigating hazards, using helicopter search and rescue equipment, and performing advanced search and rescue helicopter techniques, both inside and outside the aircraft, commensurate with the needs of the organization.

A.15.2.2(7) General hazards include, but are not limited to, temperature, altitude, rain, wind, fog, snow, utility wires/poles, trees/canopy, and loose debris, any of which could impede safe operation and/or performance of a helicopter.

A.15.2.2(8) The AHJ shall ensure that all personnel wear and use PPE during helicopter search and rescue operations. Personal protective equipment should, as a minimum, include an appropriate helmet, eye protection, hearing protection, protective clothing appropriate for the environment, footwear, and gloves.

A.15.2.2(11) A pre-flight safety briefing should include, but not be limited to, the following:

(1) Rotor hazard zones
(2) Safely approaching and departing from the helicopter
(3) Use of safety belts
(4) Operation of doors and emergency exits
(5) Location of survival equipment
(6) Location and use of required flotation equipment
(7) Location and operation of fire extinguishers
(8) Location and operation of emergency locator transmitter (ELT)
(9) Location and operation of emergency fuel shutoff
(10) Crash and emergency procedures

A.15.3.2(2) Standard crew complements can be addressed in existing guidance, such as the *International Aeronautical and Maritime Search and Rescue Manual*. However, no fewer than one observer, in addition to the pilot, is recommended in an aircraft during helicopter search operations and, no fewer than two personnel (one a rescuer, one a crew chief/spotter), in addition to the pilot, are recommended in an aircraft during helicopter rescue operations.

A.15.3.2(5) Crash egress and survival training appropriate to the environment includes being taught how to exit the helicopter post-crash and how to survive in any environment that might be encountered in the area of operation until rescued.

A.15.4.2(6) For more information, see the *Aeronautical Information Manual* (AIM) (or a similar document), available at www.faa.gov.

A.15.4.2(7) A temporary landing zone is any nonpermanent location selected for a helicopter to land away from an airport. A helispot is an incident command system (ICS) term for a similar location that is defined as "a location where a helicopter can take off and land; some helispots may be used for temporary loading."

A.16.2.3(2) The assessment phase includes an evaluation of the subject's condition and the subject's ability to assist in his or her own rescue. Consideration should be given to the need for other types of water rescue early in the assessment phase. The best intended surface rescue could eventually require other capabilities.

A.16.2.3(3) See A.4.3.5.

A.16.2.3(4) The emergency response system includes, but is not limited to, operations- and technician-level organizations capable of responding to various types of search and rescue incidents, as well as local, state, and national resources.

A.16.2.3(5) These procedures should include the process of achieving and maintaining control of the site and the perimeter. This might include management of all civilian and nonemergency personnel and establishment of operational zones and site security.

A.16.2.3(6) General hazards associated with water search and rescue operations can present the AHJ with uniquely challenging situations. The AHJ should consider the following potential hazards when providing training to its members:

(1) *Utilities.* Control of the utilities in and around a water incident is critical to ensure the safety of responding personnel and victims. The AHJ should provide its members with training in the control of these services to provide a safe environment for them to operate in and to ensure the safety of victims. The following utilities should be considered when providing training:
    (a) Electrical services (primary and secondary)
    (b) Gas, propane, fuel oil, or other alternative energy sources (primary systems)
    (c) Water/steam
    (d) Sanitary systems
    (e) Communications
    (f) Secondary service systems (such as compressed, medical, or industrial gases)
(2) *Hazardous Materials.* Water incident sites might include various materials unique to a site that, when released during a search and rescue operation, could pose a hazard to victims and responders. The AHJ should provide its members with training in the recognition of potential hazardous material releases, the determination of an existing hazard, and the methods used to contain, confine, or divert hazardous materials to conduct operations safely and effectively.
(3) *Personal Hazards.* At the site of any water incident, there are many dangers that pose personal injury hazards to the responders. The AHJ should train its members to recognize the personal hazards they encounter and to use the methods needed to mitigate these hazards to help ensure members' safety. Every member should be made aware of hazards such as trips, falls, blows, punctures, impalement, and so forth.
(4) *Confined Space.* Some water incident sites necessitate a confined space rescue. Responding personnel should be familiar with and trained in confined space rescue requirements and techniques. The AHJ should determine the applicable laws and standards related to confined space rescue and should provide training to its members in confined space rescue.

(5) *Hazards That Are Immediately Dangerous to Life and Health.* These hazards include swift water with currents exceeding those in which a person or watercraft can safely and effectively operate.
(6) *Other Hazards.* There are numerous other hazards associated with water search and rescue operations. The AHJ should make every effort to identify the hazards that might be encountered within the jurisdiction and should provide its members with training and awareness of these other hazards to allow them to perform search and rescue operations safely and effectively.
(7) *General Area.* The general area around a water incident site is the entire area around a search and rescue site. Any member operating within the vicinity of the water's edge can accidentally enter the hazard zone. PPE should be utilized accordingly. Making the general area safe includes, but is not necessarily limited to, the following:
    (a) Controlling/limiting access to the area by unnecessary personnel
    (b) Identifying hazards and removing or reducing their impact
    (c) Using personal flotation devices (PFDs) and other PPE

A.16.2.3(7) While in rescue mode, the assessment to move to recovery is an ongoing process that should be updated as incident information becomes available. The AHJ should have procedures in place to optimize the survivability of the potential victim during this process. This typically includes actions that maximize the benefit to the subject but pose minimal risk to the responder. At the awareness level there is little action expected of responders that could introduce risk to the operation. Consequently, the bias should lean toward rescue mode unless there is a clear indication that the event is not survivable. As resources with greater capability arrive, the ability to conduct a more comprehensive risk benefit analysis can be conducted. Figure A.16.2.3(7) illustrates just one example of how contributing factors can be compiled into a risk benefit analysis for surface water rescue operations.

A.16.3.2 For the purposes of this chapter, a rescue watercraft includes powered and non-powered vessels and craft that are intended to carry rescuers and victims. It is not intended to include rescue devices such as swim aids, paddle boards, and rescue boards that might accommodate a victim but are typically not classified as vessels or watercraft.

The intent of 16.3.2 is to ensure that members responsible for operating the watercraft or its equipment and systems are trained to perform the related functions under conditions that are as similar as possible to the most demanding potential work environment. This requirement does not to apply to rescuers aboard the watercraft who are using the craft as a work platform to fulfill the rescue mission and whose primary function is exclusive of operating the vessel or its systems.

A.16.3.3 For the purposes of this chapter a rescue watercraft includes powered and non-powered vessels and craft that are intended to carry rescuers and victims. It is not intended to include rescue devices such as swim aids, paddle boards, and rescue boards that might accommodate a victim but are typically not classified as vessels or watercraft. The intent of 16.3.3 is to ensure that members responsible for actually operating the watercraft or its equipment and systems are trained to perform the related functions under conditions that are as similar as possible to the most demanding potential work environment. This requirement does not apply to rescuers aboard the watercraft who are using the craft as a work platform to fulfill the rescue mission and whose primary function is exclusive of operating the vessel or its systems.

A.16.3.4(1) The victim survival window will depend on many factors, including whether the victim's location is known, water and weather conditions, immersion time, age, physical condition, and factors that contributed to the immersion such as injury or illness. Medical research is continually providing new information on criteria that impacts the survival of near-drowning victims. Agencies that perform these rescue operations should have adequate guidance available to potential rescuers to determine the likelihood of survival of water-bound victims. See Figure A.16.2.3(7) for awareness-level surface water rescue.

A.16.3.4(2) Risks associated with water rescue operations can be dynamic, involving tides, weather, water conditions, and other factors that the rescuer cannot influence as part of the rescue plan. There are also components of the risk assessment that can be influenced by the agency, both in the planning phase and in the response phase. These include the size and capabilities of the rescue team and the condition of its members, the establishment of intervention resources or procedures, facilitating methods of removal or egress of rescuers from the hazard zone, rescue equipment provided, and the staffing levels of responding teams. The risk level can typically be adjusted or moderated as additional resources are moved into place, but this is often at the expense of the survivability profile as time continues to elapse.

A.16.3.5 For the purposes of this chapter, the PPE is intended to protect a rescuer from the effects of accidental immersion and to help facilitate timely removal from the water to ensure survival. Rescuers at the operations level are not expected to enter the water as part of the rescue plan. The term "hazard zone" as it is used here is intended to describe areas where the combination of water depth and the likelihood for accidental immersion pose a risk toot the responder. It is recognized that additional PPE might be required based on the task the rescuer has been assigned, environmental conditions, physical hazards, and other factors that could pose a risk to the responder.

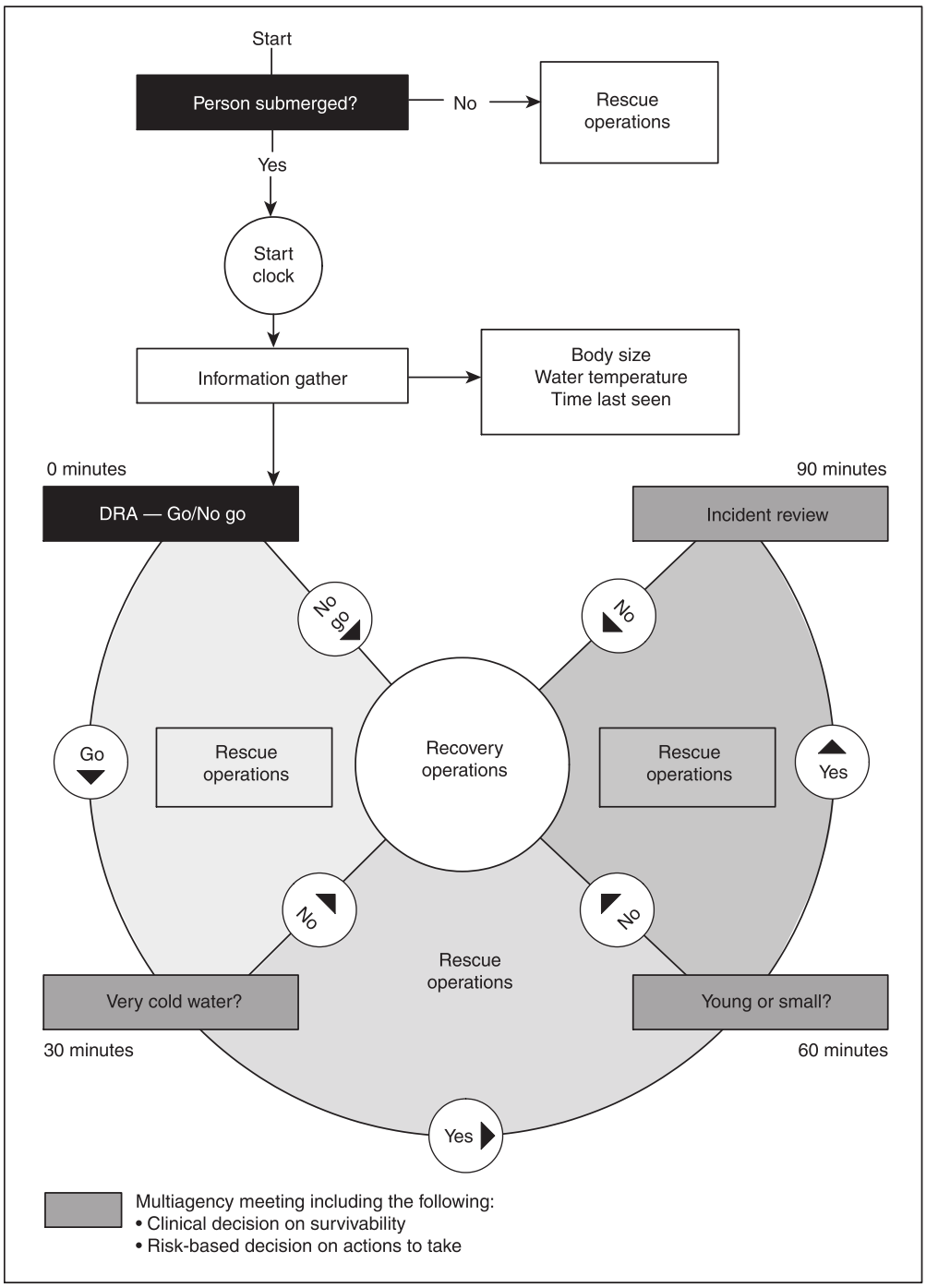


FIGURE A.16.2.3(7) UK Submersion Guidelines. *(Courtesy of the UKFRS National Operational Guidance Programme.)*

A.16.3.5(1) Flotation aids, personal flotation devices, and other water-related PPE can come with a range of certifications and approvals from various national and international agencies. The same PFD might not be appropriate for all water rescue incidents to which the agency responds, or even for to rescuers with different roles at the same incident. The intent of 16.3.5(1) is that the device be capable of being worn or attached to the rescuer and will provide no less than 15.5 lb of inherent or on-demand positive buoyancy. The AHJ is responsible to perform a task analysis and to ensure that responders are provided the proper PPE for the work to be performed.

Agencies that provide information for approval for such devices include the following:

(1) The Lifesaving and Fire Safety Division of the United States Coast Guard
(2) The Office of Boating Safety of Transport Canada

CE and ISO standards deal with various categories of buoyancy performance. The rating is for an adult size, so smaller sizes have proportionally less buoyancy:

(1) EN ISO 12402-5, covers buoyancy aids, providing a minimum of 5 kg of buoyancy. Products that carry this approval include anglers vests, waterski vests, personal watercraft vests, wakeboarding vests, and various dinghy and canoe vests.
(2) EN ISO 12402-4, covers lifejackets, providing a minimum of 10 kg of buoyancy. Products that carry this approval include foam lifejackets for both adults and children.
(3) EN ISO 12402-3, covers lifejackets providing a minimum of 15 kg of buoyancy. Products that carry this approval include the majority of manual and automatic lifejackets for both adults and children.
(4) EN ISO 12402-2, covers lifejackets providing a minimum of 27.5 kg of buoyancy. Products that carry this approval include lifejackets for offshore use.

In addition to "approved" PDFs, the AHJ might designate hazard- or mission-specific PPE or rescue tools as providing a trained responder sufficient reserve buoyancy, negating the need for an additional PFD. Examples include inherently buoyant ice rescue suits, diving buoyancy compensators and water rescue floatation cans with a leash.

A.16.3.5(3) This would include reflective striping, strobes, flashlights, chemical light sticks, or other light sources as recognized by the AHJ.

A.16.3.6(1) The size-up should include, but not be limited to, the initial and continuous evaluation of the following:

(1) Scope, magnitude, and nature of the incident
(2) Location and number of victims
(3) Risk benefit analysis
(4) Separation, isolation, security, and interviewing of witnesses
(5) Hazards such as disrupted or exposed utilities, standing or flowing water, mechanical hazards, hazmat, and explosives
(6) Access to the scene
(7) Environmental factors
(8) Resource assessment, internal and external
(9) Rescue versus recovery

A.16.3.6(2) These procedures include, but are not limited to, ensuring rescuers are wearing the wearing of proper PPE, using procedural checklists, ensuring site security (keeping bystanders back), reviewing the operational plan (and one's place in the plan), reviewing communications procedures (rescuer to tender, tender to shore, rescuer to rescuer), reviewing emergency procedures, wearing proper attire for the potential weather, reviewing procedures for equipment handling, and ensuring proper rest and attitude for the operation. For positive outcomes, water rescue requires a combination of knowledge, skills, abilities, physical fitness, and judgment. All will be gained through a combination of training and experience.

A.16.3.6(3) Hazards to both victim and rescuer include, but are not limited to, the following:

(1) Holes
(2) Strainers
(3) Hydraulics
(4) Low head dams
(5) Debris
(6) Cold water
(7) Currents
(8) Undercuts
(9) Backwash
(10) Outwash
(11) Contamination
(12) Obstructions
(13) Turbidity

A.16.3.6(6) It is important that the organization be capable of to continuously evaluating the effectiveness of the chosen plan of action. If the initial plan is not working, or requires modification to ensure safety or effectiveness, the plan should be changed. The potential for "tunnel vision" (a narrow focus excluding important influences) should be considered by those running the operation.

A.16.3.6(7) Shore-based rescues include, but are not limited to, reaching to a victim, throwing something to a victim (e.g., rope, buoy), and talking a victim into self-rescue. Items readily available on shore can be used to reach to a victim in the water while not exposing the rescuer to undue risk. Important aspects of reaching techniques include body position and reaching device selection (i.e., anything that can be used to extend a rescuer's reach). Many items found on shore (e.g., throw bag, PFD, ring buoy, manufactured flotation or rope-throwing devices) can be thrown to a victim to use as a flotation device or to pull the victim to shore.

A.16.3.6(8) The accurate use of throw bags takes practice and knowledge of proper body position, throwing technique, rope retrieval technique, and target selection (e.g., upstream in moving water, slightly beyond the victim).

A.16.3.6(9) Members of organizations at the operations level should have the ability to assist other rescue personnel with the construction of rope rescue systems. Skills involved in supplying this assistance include, but are not limited to, equipment identification, knot-tying capability, and limited knowledge of how the applicable rope rescue equipment should be used.

A.16.3.6(10) The intent of 16.3.6(10) is to include both incident-specific actions, such as staging of resources (e.g., ladders, life rings, vessels, or standby swimmers) for the intervention of rescuers, and organizational elements, such as training members on accidental immersion survival and removal tactics for the specific conditions responders are likely to encounter.

Procedures for survival swimming and self-rescue from entrapment are important because a rescuers might find themselves unintentionally in the water and trapped. These procedures should include, but are not limited to, the following abilities:

(1) Floating and swimming with and without flotation
(2) Conserving body heat while immersed in water (heat escape–lessening position)
(3) Using one's clothing for flotation
(4) Removing oneself from the water by climbing into a boat and, exiting at shore, from a pool's edge
(5) Extricating oneself from foot, body, and equipment entanglements

A.16.3.6(11) Environmental conditions such as weather and temperature play an important role in a rescuer's safety and comfort. Cold temperatures can lead to hypothermia and/or local cold injuries that can seriously impair a rescuer's ability to think and act. Wetness, through perspiration or from the environment, can substantially increase the speed at which a rescuer becomes affected by cold. Therefore, thermal protection from the elements is essential for safe operations in cold and wet environments.

It is also very important to remember that all environments can lead to heat stress as well. For example, much of the apparel designed for rescue operations is waterproof and insulated to protect the rescuer from wetness and heat loss. Unfortunately, such garments impair the body's most effective means of thermal regulation: the evaporation of perspiration from the skin. In all environments and conditions, rescuers wearing PPE should be monitored for thermal stress (e.g., overheating). Preoperation physical exams, appropriate hydration/nutrition, and monitored rehabilitation are essential for safe operations and healthy personnel.

A.16.3.6(14) Boat-based operations include, but are not limited to, the capability to perform surface support operations from within a boat while in surf, on the water, or on ice (whichever is applicable). Agencies that operate watercraft as part of their rescue operation would comply with the watercraft chapter of this document.

A.16.3.6(16) Accessible victims are those who can be retrieved without the rescuer having to venture out onto the ice or into the water.

A.16.3.6(18) This might include methods of search, stabilization, or access that do not require rescuers to enter the water or the water-bound vehicle.

A.16.4.2(3) The intervention plan might include one or more of the following: the use of a back-up rescuer(s), downstream safety, team, spotters, standby watercraft, and retrieval lines or ladders.

A.16.4.2(4) For example, establish a last seen point as a primary search area.

A.17.2.3(2) The assessment phase includes an evaluation of the subject's condition and the subject's ability to assist in his or her own rescue. Consideration should be given to the need for dive rescue early in the assessment phase. The best intended surface rescue could eventually require dive capability.

A.17.2.3(3) See A.4.2.6.

A.17.2.3(4) The emergency response system includes, but is not limited to, operations- and technician-level organizations capable of responding to various types of search and rescue incidents, as well as local, state, and national resources.

A.17.2.3(5) These procedures should include the process of achieving and maintaining control of the site and the perimeter. This might include management of all civilian and nonemergency personnel and establishment of operational zones and site security.

A.17.2.3(6) General hazards associated with water search and rescue operations can present the AHJ with uniquely challenging situations. The AHJ should consider the following potential hazards when providing training to its members.

(1) *Utilities.* Control of the utilities in and around a water incident is critical to ensure the safety of responding personnel and victims. The AHJ should provide its members with training in the control of these services to provide a safe environment for them to operate in and to ensure the safety of victims. The following utilities should be considered when providing training:
    (a) Electrical services (primary and secondary)
    (b) Gas, propane, fuel oil, or other alternative energy sources (primary systems)
    (c) Water/steam
    (d) Sanitary systems
    (e) Communications
    (f) Secondary service systems (such as compressed, medical, or industrial gases)
(2) *Hazardous Materials.* Water incident sites might include various materials unique to a site that, when released during a search and rescue operation, could pose a hazard to victims and responders. The AHJ should provide its members with training in the recognition of potential hazardous material releases, the determination of an existing hazard, and the methods used to contain, confine, or divert hazardous materials to conduct operations safely and effectively.
(3) *Personal Hazards.* At the site of any water incident, there are many dangers that pose personal injury hazards to the responders. The AHJ should train its members to recognize the personal hazards they encounter and to use the methods needed to mitigate these hazards to help ensure members' safety. Every member should be made aware of hazards such as trips, falls, blows, punctures, impalement, and so forth.
(4) *Confined Space.* Some water incident sites necessitate a confined space rescue. Responding personnel should be familiar with and trained in confined space rescue requirements and techniques. The AHJ should determine the applicable laws and standards related to confined space rescue and should provide training to its members in confined space rescue.
(5) *Hazards That Are Immediately Dangerous to Life and Health.* These hazards include swift water with currents exceeding those in which a person or watercraft can safely and effectively operate.
(6) *Other Hazards.* There are numerous other hazards associated with water search and rescue operations. The AHJ should make every effort to identify the hazards that might be encountered within the jurisdiction and should provide its members with training and awareness of these other hazards to allow them to perform search and rescue operations safely and effectively.

(7) *General Area.* The general area around a water incident site is the entire area around a search and rescue site. Any member operating within the vicinity of the water's edge can accidentally enter the hazard zone. PPE should be utilized accordingly.

Making the general area safe includes, but is not necessarily limited to, the following:

(1) Controlling/limiting access to the area by unnecessary personnel
(2) Identifying hazards and removing or reducing their impact
(3) Using personal flotation devices (PFDs) and other PPE

A.17.3.3(3) Further requirements of PPE are included in 4.4.2 of this standard. This requirement applies to all the described disciplines.

A.18.2.3(3) The assessment phase includes an evaluation of the subject's condition and the subject's ability to assist in his or her own rescue. Consideration should be given to the need for dive rescue early in the assessment phase. The best intended surface rescue could eventually require dive capability.

A.18.2.3(4) See A.4.2.6.

A.18.2.3(5) The emergency response system includes, but is not limited to, operations and technician-level organizations capable of responding to various types of search and rescue incidents, as well as local, state, and national resources.

A.18.2.3(6) These procedures should include the process of achieving and maintaining control of the site and the perimeter. This might include management of all civilian and nonemergency personnel and establishment of operational zones and site security.

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    (a) Electrical services (primary and secondary)
    (b) Gas, propane, fuel oil, or other alternative energy sources (primary systems)
    (c) Water/steam
    (d) Sanitary systems
    (e) Communications
    (f) Secondary service systems (such as compressed, medical, or industrial gases)
(2) *Hazardous Materials.* Water incident sites might include various materials unique to a site that, when released during a search and rescue operation, could pose a hazard to victims and responders. The AHJ should provide its members with training in the recognition of potential hazardous material releases, the determination of an existing hazard, and the methods used to contain, confine, or divert hazardous materials to conduct operations safely and effectively.
(3) *Personal Hazards.* At the site of any water incident, there are many dangers that pose personal injury hazards to the responders. The AHJ should train its members to recognize the personal hazards they encounter and to use the methods needed to mitigate these hazards to help ensure members' safety. Every member should be made aware of hazards such as trips, falls, blows, punctures, impalement, and so forth.
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(5) *Hazards That Are Immediately Dangerous to Life and Health.* These hazards include swift water with currents exceeding those in which a person or watercraft can safely and effectively operate.
(6) *Other Hazards.* There are numerous other hazards associated with water search and rescue operations. The AHJ should make every effort to identify the hazards that might be encountered within the jurisdiction and should provide its members with training and awareness of these other hazards to allow them to perform search and rescue operations safely and effectively.
(7) *General Area.* The general area around a water incident site is the entire area around a search and rescue site. Any member operating within the vicinity of the water's edge can accidentally enter the hazard zone. PPE should be utilized accordingly. Making the general area safe includes, but is not necessarily limited to, the following:
    (a) Controlling/limiting access to the area by unnecessary personnel
    (b) Identifying hazards and removing or reducing their impact
    (c) Using personal flotation devices (PFDs) and other PPE

A.18.2.3(8) See language on rescue versus recovery in Chapter 16. Additionally, the search for a missing diver should include an assessment of the diver’s experience, the type of equipment the diver was using, and the estimated remaining air supply balanced against the depth of the water and other conditions.

A.18.3.3(1) See the annex material in Chapter 16 for more information on PFDs.

A.18.3.4(1) Hazards associated with dive operations include, but are not limited to, the following:

(1) Barotraumas (decompression sickness, nitrogen narcosis, oxygen toxicity, etc.)
(2) Drowning
(3) Hyperventilation
(4) Hypercarbia and other respiratory problems
(5) Anxiety reactions
(6) Fatigue and exhaustion
(7) Dehydration (electrolyte imbalances)
(8) Heat stress (i.e., heat exhaustion, stroke, and cramps)
(9) The combination of prescription medication or smoking and diving
(10) Pre-existing medical conditions or injuries
(11) Hypothermia

A.18.3.4(2) Support personnel are called upon to assist divers in preparing to dive and to dress and equip divers; to provide search pattern control and direction; to monitor divers' time, depth, dive profile, and air supply; and to provide a communication link to the surface via electronic communication equipment or manual rope pull signals.

A.18.3.4(4) Surface support personnel should be capable of recognizing, maintaining, and operating all surface support equipment used by the organization.

A.18.3.4(7) Darkness or unusual or extreme environmental conditions can require very specialized dive and/or surface support training specific to the situation(s) encountered.

A.18.4.3 Training in SCUBA diving should include, but not be limited to, the information conveyed in a widely recognized SCUBA diving program that emphasizes the role of a public safety agency or rescue organization in dive operations.

A.18.4.4 Fitness provides reserve capacity to deal with physical challenges that can occur during dive operations. Research indicates that the fitness evaluations specified in Figure A.18.4.4(a) and Figure A.18.4.4(b) provide a minimum aerobic capacity to SCUBA dive safely. Annual skill evaluations help ensure diver competence relative to fundamental survival skills. Many investigators, researchers, and authors support the belief that poor SCUBA skills are a direct or indirect cause of diver fatalities.

A.18.4.5(1) The dive supervisor is responsible for the overall management of the dive operation. At a minimum, dive supervisors possess the same knowledge and understanding of hyperbaric work as the divers and generally exceed the skill set and authority of a dive tender. The term *dive supervisor* is a term used in many commercial or governmental standards on diving and will often have a specific definition and scope of authority.

A.18.4.5(3) It is the intent of the requirement that the safety diver, also called the *backup diver*, be prepared to immediately descend and contact a diver in distress or search for a missing diver. To accomplish this, the safety diver is typically in the water with all equipment, including a full face mask, in place and ready to submerge. He/she must maintain a constant situational awareness of the general location of the divers and of any unusual events or circumstances that might require deployment. In cases where depth or distance makes timely deployment of a safety diver impractical, deploying two divers as partners might be required to manage any potential diver emergencies.

A.18.4.5(4) The intent of this requirement is to address organizational contingencies to sustain or resume a subsurface mission in the event an unplanned event disrupts a dive operation. It is not intended to require those resource(s) to be physically present at the dive site prior to initially engaging in a subsurface operation. However, these contingencies should be mobilized or activated so they can be readily deployed if required. One example of a contingency resource is the provision for a 90 percent diver.

A 90 percent diver can be located on shore but proximal to the point of entry and immediately ready to enter the water. Typically, this is a fully dressed diver for whom the pre-entry safety check has been performed and who requires only minimal pre-entry effort — usually donning fins and full face mask. His/her primary role is to enter the water and act as a backup diver should the safety diver be deployed. However, the 90 percent diver might also be required to enter the water for nonemergent reasons, such as equipment failure of a primary diver, to maintain mission continuity.

A.18.4.7(1) Dive operations involve work in an IDLH environment. To ensure safe dive operations, all divers must plan their dives to maintain an adequate reserve to manage unforeseen circumstances.

The one-third reserve should be calculated in advance for specific sizes of the cylinders used by the team by using the total volume of air, including any redundant air systems, adjusted for the rated working pressure of the cylinders associated with the breathing gas systems. From that calculation, determine the primary system pressure that would leave the diver with approximately one third the total volume in reserve. It is not the intent to calculate the reserve pressure based on the actual pressure of the cylinder at the start of the dive but always with the rated working pressure of the cylinder.

A diver equipped with only a standard aluminum cylinder 80 gets 80 ft^3 (2.27 m^3) at 3000 psi. Because there is no redundant air supply (RAS), the entire reserve one-third volume of 26.6 ft^3 (0.74 m^3) must be carried in the primary system.

$(26.6\ ft^3 \times 3000\ psi) / 80\ ft^3 = 1000\ psi$

A diver equipped with an 80 ft^3 (2.27 m^3) primary HP Steel and Pony cylinder with a working pressure of 3500 psi and 21 ft^3 (0.59 m^3) redundant air system cylinder has a total of 101 ft^3 (2.86 m^3). The diver needs to be on the surface with approximately 33.6 ft^3 (0.93 m^3) to meet the one third. Subtract the 21 ft^3 (0.59 m^3) provided in the RAS cylinder to leave 12.6 ft^3 (0.34 m^3) in the primary for the required reserve.

$(12.6\ ft^3 \times 3500\ psi) / 80\ ft^3 = 472\ psi$

Even though the calculated minimum surface reserve pressure is 472 psi (3255 kPa), the minimum permissible breathing gas pressure is 500 psi. In this case the diver's minimum primary reserve pressure is 500 psi.

Ensuring that divers comply with the required minimum reserve pressure is often a challenge to agencies that perform public safety diving. Ensuring that divers get adequate training using the established limits, including calculating additional air required to perform the ascent and relevant safety stops, is a key element to ensuring compliance. Training should be conducted at depths and under conditions that simulate an actual rescue environment while performing mission-specific work as often as possible so that divers can set proper expectations about air consumption and exertion levels. Instances where divers violate the minimum reserve pressure should be treated as a breach of policy, and the contributing factors should be documented to prevent recurrence. The AHJ is responsible for holding divers and supervisors accountable for compliance with established limits.

A.18.4.7(3) Safe use of dive tables means precise use of nationally recognized dive tables specified for the type of dive operation undertaken. Agencies that use dive computers for managing and measuring hyperbaric exposure need to be fully educated on the algorithms used by the device to plot the diver's gas loading as computers are typically not as conservative as dive tables.

I.A.D.R.S. ANNUAL WATERMANSHIP TEST

EVALUATION PARAMETERS

There are five exercises that evaluate stamina and comfort in the water, each rated by points.
The diver must successfully complete all stations and score a minimum of 12 points to pass the test.
The test should be completed with not more than 15 minutes between exercises.

Exercise 1: 500 Yard Swim

The diver must swim 500 yards without stopping using a forward stroke and without using any swim aids such as a dive mask, fins, snorkel, or flotation device. Stopping or standing up in the shallow end of the pool at any point during this exercise will constitute a failure of this evaluation station.

Time to Complete	Points Awarded
Under 10 minutes	5
10-13 minutes	4
13-16 minutes	3
16-19 minutes	2
More than 19 minutes	1
Stopped or incomplete	Incomplete

Exercise 2: 15 Minute Tread

Using no swim aids and wearing only a swimsuit the diver will stay afloat by treading water, drown proofing, bobbing or floating for 15 minutes with hands only out of the water for the last 2 minutes.

Performance Criteria	Points Awarded
Performed satisfactorily	5
Stayed afloat, hands not out of water for 2 minutes	3
Used side or bottom of support at any time	1
Used side or bottom for support>twice	Incomplete

Exercise 3: 800 Yard Snorkel Swim

Using a dive mask, fins, snorkel, and a swimsuit (no BCD or other flotation aid) and swimming the entire time with the face in the water, the diver must swim non stop for 800 yards. The diver must not arms to swim at any time.

Performance Criteria	Points Awarded
Under 15 minutes	5
15-17 minutes	4
17-19 minutes	3
19-21 minutes	2
More than 21 minutes	1
Stopped at any time	Incomplete

Exercise 4: 100 Yard Inert Rescue Tow

The swimmer must push or tow an inert victim wearing appropriate PPE on the surface 100 yards non stop and without assistance.

Performance Criteria	Points Awarded
Under 2 minutes	5
2-3 minutes	4
3-4 minutes	3
4-5 minutes	2
More than 5 minutes	1
Stopped at any time	Incomplete

Exercise 5: Free Dive to a depth of nine feet and retrieve an object

Performance Criteria	Points Awarded
Performed satisfactorily	Pass
Stopped or incomplete	Incomplete

Additional copies available at no charge via the International Association of Dive Rescue Specialists webpage. Vist www.IADRS.org

FIGURE A.18.4.4(a) Watermanship/Skills Test. *(Source: International Association of Dive Rescue Specialists.)*

I.A.D.R.S. Annual Basic Scuba Skills Evaluation

Diver's Name: _____ Department: _____

Air Consumption: Start _____ psi / Finish _____ psi Time: Start _____ / Finish _____ / Total _____

Water Depth: _____ Pool / Open Water (circle one) Examiner: _____

Task grading: S = Satisfactory N = Needs Improvement (specify) N/A = Not Applicable (use for equipment only)

Equipment Handling and Set-Up

_____ properly assembles equipment (basic gear / specialty gear)
_____ shows familiarity and comfort with equipment
_____ properly protects equipment (i.e. tank valve / regulator)
_____ review (line & hand signals / air consumption rates / buddy awareness / emergencies / diver log)

Watermanship Skills

_____ 500 yard continuous forward stroke swim - no swim aids for time (refer to grading criteria)
_____ 15 minute tread / last 2 minutes with hands out of water (refer to grading criteria)
_____ 800 yard snorkel swim (refer to grading criteria)
_____ 100 yard inert diver rescue tow (refer to grading criteria)

Skin Diving Skills

_____ mask clearing
_____ snorkel clearing (popping & expansion)
_____ snorkel without mask (led by partner, 1 lap)
_____ fin kicks (flutter / dolphin) one length each, using mask and snorkel
_____ in-water surface dives (head first / feet first)

SCUBA Diving Skills

_____ entries (giant stride / seated or controlled entry)
_____ neutral buoyancy control (oral / power) inflation
_____ dry suit buoyancy control and emergency procedures (i.e., hose disconnect or flooding)
_____ regulator clearing (blowing / purging) and retrieval
_____ regulator without mask (led by partner, 1 lap)
_____ full face mask (removal / switch to regulator / clearing full face mask / replace full face mask)
_____ descent procedures (signal / check time & air / raise inflator hose / feet first descent / clear ears)
_____ ascent procedures (signal / check time & depth / + buoyancy / raise inflator hose / ascend @ 20 ft/min)
_____ air sharing at depth and during ascent
_____ buddy breathing at depth and during ascent
_____ emergency swimming ascent procedures (simulate out of air / signals / ascends / continuous exhaling / surfaces / inflates BC orally using bobbing technique)
_____ emergency buoyant ascent procedures (simulate out of air / signals / drops weights / ascends / continuous exhaling / surfaces / inflates BC orally using bobbing technique)
_____ weight belt (removal / replacement) on surface and bottom
_____ buoyancy control device (removal / replacement) on surface and bottom
_____ OPTIONS: Blackout Mask / Night Dive / Navigation / Confidence Obstacle Course

Performance Comments: _____

_____

Equipment Care and Storage

_____ properly disassembles equipment
_____ cleans and restores equipment properly

Additional copies available at no charge via the International Association of Dive Rescue Specialists webpage. Visit www.IADRS.org

FIGURE A.18.4.4(b) Basic SCUBA Skills Evaluation. *(Source: International Association of Dive Rescue Specialists.)*

A.18.4.7(7) Some widely recognized search techniques include fan patterns, circle searches, jackstay, and drip line patterns.

A.18.4.7(8) The need to perform a complete or rapid field neuro checklist *[see Figure A.18.4.7(8)]* is not limited to divers who exhibit symptoms of DCS. Divers who work in conditions that are unusually deep, cold, or arduous should also receive a structured exam regardless if they are initially symptomatic.

A.18.4.7(10) For public safety diving, the use of full-face mask regulators and voice communication tools is largely universal. These systems add enormous efficiencies and a margin of safety for divers. These systems provide the ability for surface support personnel to continuously monitor both a diver's comfort and general physiological state. The preferred method is full duplex (simultaneous bidirectional communication) to allow the respirations and comfort of the diver to be monitored continuously and is vital to ensuring the diver's safety. However, agencies should also have alternative means of communicating basic commands to divers both on the surface and while submerged. A common alternative method uses line pulls between a tethered diver and a tender to communicate general information and commands.

A.18.4.7(11) A diver running out of air for any reason is an immediately life-threatening event. Practices and tools that address this possibility are vital to the survival of public safety divers. Ideally each diver has a redundant air system, complete with a separate air source and independent delivery system. Training on associated techniques to provide buoyancy when the diver has no compressed air in his/her cylinder should also be included. *(See 3.3.171 for the definition of a redundant air system and A.3.3.171 for related annex material.)*

A.18.4.7(12) Public safety divers are exposed to a growing list of known and unknown chemical and biological contaminants. Exposure prevention is the best way to avoid potential problems. Examples of chemical exposures include those secondary to submerged vehicles, industrial chemicals, sewage runoff, and so on. Examples of biological hazards include *Pfiesteria dinoflagellates*, *Naegleria amoeba*, and fecal coliforms.

A.18.4.7(13) The death of a public safety diver is often associated with entanglement. Safe and effective procedures to rescue entangled divers are vital to operations and necessary to improve the overall safety of public safety diving.

A.18.4.7(14) See Chapter 18 of NFPA 470 for pre-entry and postentry monitoring. An abbreviated exam in rescue mode can consist of oral history only (e.g., level of consciousness, recent illness, injury, or medication; recent alcohol ingestion; problems incompatible with equalizing). This exam can be accomplished as the diver is dressing.

A.18.4.7(15) Many public safety dive teams assist or provide evidence work as part of their mission. These skills must be performed correctly for a complete and successful outcome.

A.18.4.7(16) The dive emergency response plan is a tool developed by the agency as a resource for the dive supervisor and tender in the event one of the agency's divers is missing, ill, or injured. It should be readily available at the dive site for all operations where divers are committed to the water and should include the following:

(1) Contact information for local medical providers who deal with hyperbaric emergencies
(2) A copy of the agency's dive policy
(3) Pre-entry check sheets
(4) Pre- and postdive medical evaluation criteria
(5) Action plan for projected emergencies, such as missing diver, and so forth

A.18.4.7(18) See Figure A.18.4.7(18).

A.18.4.8 Ideally, this exam is conducted by a board-certified hyperbaric physician.

A.18.4.11 It is the intent that divers in the organization perform approximately one dive per quarter, performing functions in the scope of team work and filling roles typically used when deploying in accordance with the team's operating guidelines or best practices. This would be in addition to dives focused on personal skills or comfort in the water. Dives performed at actual incidents can count toward the required four annual dives.

A.19.2.3(2) The assessment phase includes an evaluation of the subject's condition and the subject's ability to assist in his or her own rescue. Consideration should be given to the need for dive rescue early in the assessment phase. The best intended surface rescue could eventually require dive capability.

A.19.2.3(3) See A.4.2.6.

A.19.2.3(4) The emergency response system includes, but is not limited to, operations- and technician-level organizations capable of responding to various types of search and rescue incidents, as well as local, state, and national resources.

A.19.2.3(5) These procedures should include the process of achieving and maintaining control of the site and the perimeter. This might include management of all civilian and non-emergency personnel and establishment of operational zones and site security.

The Rapid Field Neuro Exam

Mental Status:

1) Ask the diver to state his name, where he is, the time of day, and most recent activity.
2) Evaluate his speech for clearness and appropriateness.

Cranial Nerves:

1) Sight / Eye movements:
    a) Hold up different numbers of fingers for the diver to count.
    b) Have the diver follow your finger with his eyes while keeping his head straight. Move your finger up, down, left and right. Watch for nystagmus.
2) Facial Movements:
    a) Place your fingers at the angle of the diver's jaw and ask him to clench his teeth.
    b) Ask him to wrinkle his forehead as you smooth the skin.
    c) Instruct him to stick his tongue out and move it in all four directions.
    d) Check the diver's smile for symmetry.
3) Head / Shoulder Movement:
    a) Ask the diver to tilt his head back and swallow. Watch for his "Adams Apple" to move.
    b) Push down lightly on his shoulders, asking him to shrug.
    c) Put your hand on one side of the diver's face and ask him to push against it. Do the same with the other side, and on the forehead and back of the head.
4) Hearing:
    a) Rub your fingers together close to the diver's ears to identify the sounds he's to listen for.
    b) Ask him to close his eyes.
    c) Move your hand away from his ear and make the sound again.
    d) Continue to make the sound as you move your hand back towards the ear.
    e) Ask him to tell you when he can hear the sound again.

Sensations:

1) The objective is to evaluate the sense of light touch and make sure it's equal on both sides of the body.
2) Sensations are checked with the diver's eyes closed, pockets empty, and the diver dressed down to light clothing or bare skin.
3) Tell the diver that the light touch should feel normal and the same on both sides of his body.
4) Evaluate the body sections, checking the right and left sides at the same time. Overlap the sections slightly.
5) Run your fingers across the forehead, down the sides of the face and along the jaw line.
6) Then run your fingers down the diver's chest, abdomen, front of arms, legs and across the hands.
7) Turn him around and run your fingers down his back, buttocks, and the backs of the arms and legs.

Muscle Tone:

1) The objective is to evaluate muscle tone and determine that it's equal on both sides of the body.
2) Have the diver bend his arms so that his hands meet in the center of his chest. With his arms bent have him bring his elbows up level with his shoulders (or demonstrate the move and say "Do this").
3) Tell him to push against you as you push his elbows up, then down, and pull his hands away from his chest and push them back.
4) To evaluate grip strength in each hand, ask him to squeeze two of your fingers.
5) Leg evaluation: With diver sitting, evaluate both legs. Put your hand on his thigh and ask him to pick the leg up against resistance. Then put your hand under the thigh and ask him to pull down. Put your hands on the front of his lower legs and ask him to push out. Then put your hands behind the legs and ask him to pull back.
6) Leg evaluation: With diver laying, evaluate both legs. Ask him to do a straight leg raise as you lightly push down on the leg. Have him bend the leg up and push against your hand as you hold his foot.
7) Foot evaluation: Have the diver pull his feet up as you push them down and then push against your hands as if pushing on a pedal.

Balance and Coordination:

1) The objective is to make sure that the diver can hold himself upright, move without being off balance and that he has normal hand/eye coordination. Protect the diver from falling.
2) Romberg Test: Have the diver stand upright with his eyes closed, feet together and arms outstretched in front of him. Ask him to stand this way for several seconds. Then ask him to walk in place, bringing his knees up. Eyes remain closed.
3) Heel-shin slide: If the diver is laying down, have him place the heel of one foot on the opposite leg, just below the knee. Then have him run the heel down his shin to the ankle. Do both legs.
4) Alternating hand movements: Have the diver alternately touch his index finger to his nose and then to your finger, held about 18" (.5 meters) away from his face. Repeat the movement several times and test both hands.

Vital Signs (If trained and equipped):

1) The objective is to evaluate the findings in the Rapid Field Neuro Exam with the baseline vitals.
2) Blood pressure
3) Pulse
4) Respirations

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FIGURE A.18.4.7(8) Field Neuro Check Sheet. ***(Source: Dive Rescue International.)***

Rapid Field Neuro Checksheet

DIVE RESCUE INTERNATIONAL

Diver's Name: _____ **Name of Examiner:** _____

Date: _____ **Initial Complaint:** _____

Time									Notes
Mental Status: Do they know:	Yes	No	Yes	No	Yes	No	Yes	No	
1) Their name?									
2) Where they are?									
3) Time of day?									
4) Most recent activity?									
5) Speech is clear, correct?									
Sight:	Yes	No	Yes	No	Yes	No	Yes	No	
1) Correctly counts fingers?									
2) Vision clear?									
Eye Movements:	Yes	No	Yes	No	Yes	No	Yes	No	
1) Move all four directions?									
2) Nystagmus absent?									
Facial Movements?	Yes	No	Yes	No	Yes	No	Yes	No	
1) Teeth clench OK?									
2) Able to wrinkle forehead?									
3) Tongue moves all directions?									
4) Smile symmetrical?									
Head/Shoulder Movements:	Yes	No	Yes	No	Yes	No	Yes	No	
1) "Adams Apple" moves?									
2) Shoulder shrug normal, equal?									
3) Head movements normal, equal?									
Hearing:	Yes	No	Yes	No	Yes	No	Yes	No	
1) Normal for that diver?									
2) Equal both ears?									
Sensations: Present, normal and Symmetrical across?	Yes	No	Yes	No	Yes	No	Yes	No	
1) Face									
2) Chest									
3) Abdomen									
4) Arms (front)									
5) Hands									
6) Legs (front)									
7) Feet									
8) Back									
9) Arms (back)									
10) Buttocks									
11) Legs (back)									
Muscle Tone: Present, normal and symmetrical for:	Yes	No	Yes	No	Yes	No	Yes	No	
1) Arms									
2) Hand grips									
3) Legs									
4) Feet									
Balance and Coordination:	Yes	No	Yes	No	Yes	No	Yes	No	
1) Romberg OK?									
2) If Supine: Heel-shin slide OK?									
3) Alternating hand movements OK?									
Vital Signs:									
1) Blood pressure									
2) Pulse									
3) Respirations									

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FIGURE A.18.4.7(8) ***Continued***

Dive Checklist/Operations Worksheet

Primary Diver	Safety Diver	90% Diver
Tender _____	Tender _____	Tender _____
Diver _____	Diver _____	Diver _____

Primary Diver	Safety Diver	90% Diver
_____ Hood	_____ Hood	_____ Hood
_____ Mask	_____ Mask	_____ Mask
_____ Full face mask	_____ Full face mask	_____ Full face mask
_____ Wet/dry suit	_____ Wet/dry suit	_____ Wet/dry suit
_____ Harness/carabiner locked	_____ Harness/carabiner locked	_____ Harness/carabiner locked
_____ Quick release snap shackle	_____ Quick release snap shackle	_____ Quick release snap shackle
_____ Buoyancy control device	_____ Buoyancy control device	_____ Buoyancy control device
_____ Regulator	_____ Regulator	_____ Regulator
_____ Depth gauge/pressure gauge	_____ Depth gauge/pressure gauge	_____ Depth gauge/pressure gauge
_____ Octopus/alternate air source	_____ Octopus/alternate air source	_____ Octopus/alternate air source
_____ Compass	_____ Compass	_____ Compass
_____ Gloves	_____ Gloves	_____ Gloves
_____ 2 cutting tools	_____ 2 cutting tools	_____ 2 cutting tools
_____ Weight belt _____ lb	_____ Weight belt _____ lb	_____ Weight belt _____ lb
_____ Ankle weights	_____ Ankle weights	_____ Ankle weights
_____ Fins	_____ Fins	_____ Fins
_____ Review objective	_____ Review objective	_____ Review objective
_____ Establish initial overlap in pattern	_____ Establish initial overlap in pattern	_____ Establish initial overlap in pattern
_____ Review found object protocol	_____ Review found object protocol	_____ Review found object protocol
_____ Comm check/review line signals	_____ Comm check/review line signals	_____ Comm check/review line signals
_____ Review diver in distress protocol	_____ Review diver in distress protocol	_____ Review diver in distress protocol
_____ Review emergency procedures	_____ Review emergency procedures	_____ Review emergency procedures
Start tank pressure _____ psi	Start tank pressure _____ psi	Start tank pressure _____ psi
Start dive time: _____	Start dive time: _____	Start dive time: _____
MAX. DEPTH FOR DIVE: _____	MAX. DEPTH FOR DIVE: _____	MAX. DEPTH FOR DIVE: _____
Tank pressure _____ psi 5 minutes	Tank pressure _____ psi 5 minutes	Tank pressure _____ psi 5 minutes
Tank pressure _____ psi ____ minutes	Tank pressure _____ psi ____ minutes	Tank pressure _____ psi ____ minutes
Tank pressure _____ psi ____ minutes	Tank pressure _____ psi ____ minutes	Tank pressure _____ psi ____ minutes
Ending tank pressure _____ psi	Ending tank pressure _____ psi	Ending tank pressure _____ psi
END DIVE TIME: _____	END DIVE TIME: _____	END DIVE TIME: _____
MAX. DEPTH: _____	MAX. DEPTH: _____	MAX. DEPTH: _____
Feet/total bottom time: _____ minutes	Feet/total bottom time: _____ minutes	Feet/total bottom time: _____ minutes
RAPID FIELD NEURO Exam results: POSITIVE/NEGATIVE	RAPID FIELD NEURO Exam results: POSITIVE/NEGATIVE	RAPID FIELD NEURO Exam results: POSITIVE/NEGATIVE
(Attach copy of check sheet to this form)	(Attach copy of check sheet to this form)	(Attach copy of check sheet to this form)
TENDER SIGNATURE	TENDER SIGNATURE	TENDER SIGNATURE
DIVE SUPERVISOR SIGNATURE	DIVE SUPERVISOR SIGNATURE	DIVE SUPERVISOR SIGNATURE

FIGURE A.18.4.7(18) Dive Checklist. *(Source: Dive Rescue International.)*

A.19.2.3(6) General hazards associated with water search and rescue operations can present the AHJ with uniquely challenging situations. The AHJ should consider the following potential hazards when providing training to its members.

(1) *Utilities.* Control of the utilities in and around a water incident is critical to ensure the safety of responding personnel and victims. The AHJ should provide its members with training in the control of these services to provide a safe environment for them to operate in and to ensure the safety of victims. The following utilities should be considered when providing training:
   (a) Electrical services (primary and secondary)
   (b) Gas, propane, fuel oil, or other alternative energy sources (primary systems)
   (c) Water/steam
   (d) Sanitary systems
   (e) Communications
   (f) Secondary service systems (such as compressed, medical, or industrial gases)

(2) *Hazardous Materials.* Water incident sites might include various materials unique to a site that, when released during a search and rescue operation, could pose a hazard to victims and responders. The AHJ should provide its members with training in the recognition of potential hazardous material releases, the determination of an existing hazard, and the methods used to contain, confine, or divert hazardous materials to conduct operations safely and effectively.

(3) *Personal Hazards.* At the site of any water incident, there are many dangers that pose personal injury hazards to the responders. The AHJ should train its members to recognize the personal hazards they encounter and to use the methods needed to mitigate these hazards to help ensure members' safety. Every member should be made aware of hazards such as trips, falls, blows, punctures, impalement, and so forth.

(4) *Confined Space.* Some water incident sites necessitate a confined space rescue. Responding personnel should be familiar with and trained in confined space rescue requirements and techniques. The AHJ should determine the applicable laws and standards related to confined space rescue and should provide training to its members in confined space rescue.

(5) *Hazards That Are Immediately Dangerous to Life and Health.* These hazards include swift water with currents exceeding those in which a person or watercraft can safely and effectively operate.

(6) *Other Hazards.* There are numerous other hazards associated with water search and rescue operations. The AHJ should make every effort to identify the hazards that might be encountered within the jurisdiction and should provide its members with training and awareness of these other hazards to allow them to perform search and rescue operations safely and effectively.

(7) *General Area.* The general area around a water incident site is the entire area around a search and rescue site. Any member operating within the vicinity of the water's edge can accidentally enter the hazard zone. PPE should be utilized accordingly. Making the general area safe includes, but is not necessarily limited to, the following:
   (a) Controlling/limiting access to the area by unnecessary personnel
   (b) Identifying hazards and removing or reducing their impact
   (c) Using personal flotation devices (PFDs) and other PPE

A.20.2.3(2) The assessment phase includes an evaluation of the subject's condition and the subject's ability to assist in his or her own rescue. Consideration should be given to the need for dive rescue early in the assessment phase. The best intended surface rescue could eventually require dive capability.

A.20.2.3(3) See A.4.3.5.

A.20.2.3(4) The emergency response system includes, but is not limited to, operations- and technician-level organizations capable of responding to various types of search and rescue incidents, as well as local, state, and national resources.

A.20.2.3(5) These procedures should include the process of achieving and maintaining control of the site and the perimeter. This might include management of all civilian and nonemergency personnel and establishment of operational zones and site security.

A.20.2.3(6) General hazards associated with water search and rescue operations can present the AHJ with uniquely challenging situations. The AHJ should consider the following potential hazards when providing training to its members.

(1) *Utilities.* Control of the utilities in and around a water incident is critical to ensure the safety of responding personnel and victims. The AHJ should provide its members with training in the control of these services to provide a safe environment for them to operate in and to ensure the safety of victims. The following utilities should be considered when providing training:
   (a) Electrical services (primary and secondary)
   (b) Gas, propane, fuel oil, or other alternative energy sources (primary systems)
   (c) Water/steam
   (d) Sanitary systems
   (e) Communications
   (f) Secondary service systems (such as compressed, medical, or industrial gases)

(2) *Hazardous Materials.* Water incident sites might include various materials unique to a site that, when released during a search and rescue operation, could pose a hazard to victims and responders. The AHJ should provide its members with training in the recognition of potential hazardous material releases, the determination of an existing hazard, and the methods used to contain, confine, or divert hazardous materials to conduct operations safely and effectively.

(3) *Personal Hazards.* At the site of any water incident, there are many dangers that pose personal injury hazards to the responders. The AHJ should train its members to recognize the personal hazards they encounter and to use the methods needed to mitigate these hazards to help ensure members' safety. Every member should be made aware of hazards such as trips, falls, blows, punctures, impalement, and so forth.

(4) *Confined Space.* Some water incident sites necessitate a confined space rescue. Responding personnel should be familiar with and trained in confined space rescue requirements and techniques. The AHJ should determine the applicable laws and standards related to confined

space rescue and should provide training to its members in confined space rescue.

(5) *Hazards That Are Immediately Dangerous to Life and Health.* These hazards include swift water with currents exceeding those in which a person or watercraft can safely and effectively operate.

(6) *Other Hazards.* There are numerous other hazards associated with water search and rescue operations. The AHJ should make every effort to identify the hazards that might be encountered within the jurisdiction and should provide its members with training and awareness of these other hazards to allow them to perform search and rescue operations safely and effectively.

(7) *General Area.* The general area around a water incident site is the entire area around a search and rescue site. Any member operating within the vicinity of the water's edge can accidentally enter the hazard zone. PPE should be used accordingly. Making the general area safe includes, but is not necessarily limited to, the following:

(a) Controlling/limiting access to the area by unnecessary personnel
(b) Identifying hazards and removing or reducing their impact
(c) Using personal flotation devices (PFDs) and other PPE

A.20.2.3(7) Refer to Figure A.16.2.3(7) for an example of a rescue/recovery decision matrix tool.

A.21.1.2 For the purposes of this chapter, rescue watercraft include human-powered and motorized vessels and craft that are intended to carry rescuers and victims. It does not include rescue devices such as swim aids, paddle boards, and rescue boards, which might accommodate a victim but are not typically classified as vessels or watercraft.

A.21.1.3 The intent of 21.1.3 is that the capability for watercraft rescue as outlined in this section be structured to meet all water or weather conditions that might reasonably be encountered as part of the agency's mission. For those agencies that use watercraft to support multiple missions, the most challenging or demanding conditions should be used as the baseline. If the AHJ cannot meet the needs of all missions with a single watercraft type, then watercraft suitable for each specific mission should be used.

A.21.3.2 For the purposes of this chapter, a rescue watercraft includes human-powered and motorized vessels and craft that are intended to carry rescuers and victims. It is not intended to include rescue devices such as swim aids, paddle boards, and rescue boards, which might accommodate a victim but are not typically classified as vessels or watercraft.

The intent of 21.3.2 is to ensure that members responsible for actually operating the watercraft or its equipment and systems are provided training to perform the related functions under conditions that are as similar as possible to the most demanding potential work environment. This requirement does not apply to rescuers aboard the watercraft who are using the craft as a work platform to fulfill the rescue mission and whose primary function is exclusive of operating the vessel or its systems.

A.21.3.3 For the purposes of this chapter, the PPE is intended to protect a rescuer from the effects of accidental immersion and help facilitate timely removal from the water and ensure their survival. The term *hazard zone* as it is used here is intended to describe areas where the combination of water depth and the likelihood for accidental immersion pose a risk to the responder. Organizations performing watercraft-based rescue functions at the operations level typically are engaged in tasks that increase their exposure to the water and the potential for accidental immersion. Additionally, performing tasks in this environment might inhibit an individual's ability to remain steady or otherwise distract him/her from recognizing conditions that pose a risk for accidental immersion.

Passengers or crew who are in a cabin or inside the confines of an approved railing system and who have no duties that might expose them to immersion risk will not be required to wear a PFD. If conditions change, however, a PFD should be immediately available.

Some circumstances require all crewmembers to wear a PFD and a water rescue helmet for protection from impact and/or rapid immersion. Those circumstances include breaking or standing waves, swift water, and operating watercraft at risk for rapid capsize due to waves or obstacles.

It is recognized that additional PPE might be required based on the task the rescuer has been assigned, environmental conditions, physical hazards, and other factors that might pose a risk to the responder.

A.21.3.3(3) Visible signaling devices include reflective striping, strobes, flashlights, and other light sources as required by the AHJ.

A.21.3.4 Members of an organization at the operations level are expected to perform duties typically described as those of a deckhand or crewmember. Capabilities of organizations at this level include manipulating lines and operating pumps, capstans, radios, and any watercraft-specific rescue equipment. The primary scope of work at this level is supporting the function of the watercraft as a search and rescue tool under the direction of a vessel operator.

A.21.3.4(6) Communication methods might vary but could include hand signals, radios, lights, or audible devices. In many cases where watercraft operations and vessel traffic are common, the use of marine VHF radios with predetermined channels for specific purposes is standard practice.

A.21.3.4(7) Towing procedures can vary significantly depending on the size of the rescue craft and the vessel to be towed. Considerations also include water conditions, weather, the number of occupants, and the nature of the incident. Use of improper methods or undertaking a tow with an improperly sized vessel can pose a risk of swamping or capsizing either or both vessels. Crewmembers should be well-versed in how to connect the watercraft so the tow is accomplished safely. They should also recognize conditions when the tow should be aborted.

A.21.3.4(8) The need to deploy technician-level rescuers will vary from agency to agency based on available resources. These might include divers and/or surface water rescue technicians. Of primary importance is to ensure the watercraft and its systems pose no hazard to rescuers who are moving back and forth from the craft to the water or to rescuers who are in the water.

A.21.3.4(9) Methods for approaching and contacting waterbound subjects should include procedures for maintaining contact with or sight of the subject on approach, ensuring the watercraft or its systems do not pose a hazard to the subject or the rescuers performing the recovery, and preventing the recovery operation from compromising the stability of the watercraft.

A.21.3.4(11) Crew overboard (COB) procedures will vary by vessel and water conditions. Typically all will include maintaining visual contact with the subject, alerting the vessel operator and other crewmembers, and deploying a flotation aid or marker. In most cases, the boat operator takes specific predetermined action to maneuver the craft to recover the subject depending on where from the vessel he/she fell. However in some cases, such as swift water, maneuvering the watercraft to recover the subject might not be an option. Other resources, such as another craft or a downstream safety team, might have to be deployed.

A.21.4.2 Members of an organization at the technician level are expected to perform duties typically described as those of a boat operator. Capabilities of organizations at this level include navigating, operating the controls, communicating with crewmembers, and other related duties.

A.21.4.2(1) Towing procedures can vary significantly depending on the size of the rescue craft and the vessel to be towed. Considerations also include water conditions, weather, the number of occupants, and the nature of the incident. Use of improper methods or undertaking a tow with an improperly sized vessel can pose a risk of swamping or capsizing either or both vessels. Crewmembers should be well-versed in how to connect the watercraft so the tow is accomplished safely. They should also recognize conditions when the tow should be aborted.

A.21.4.2(2) The need to deploy technician-level rescuers will vary from agency to agency based on available resources. These might include divers and/or surface water rescue technicians. Of primary importance is to ensure the watercraft and its systems pose no hazard to rescuers who are moving back and forth from the craft to the water or to rescuers who are in the water.

A.21.4.2(3) Methods for approaching and contacting waterbound subjects should include procedures for maintaining contact with or sight of the subject on approach, ensuring the watercraft or its systems do not pose a hazard to the subject or the rescuers performing the recovery, and preventing the recovery operation from compromising the stability of the watercraft.

A.21.4.2(5) Crew overboard (COB) procedures will vary by vessel and water conditions. Typically all will include maintaining visual contact with the subject, alerting the vessel operator and other crewmembers, and deploying a flotation aid or marker. In most cases the boat operator takes specific predetermined action to maneuver the craft to recover the subject depending on where from the vessel he/she fell. However in some cases, such as swift water, maneuvering the watercraft to recover the subject might not be an option. Other resources, such as another craft or a downstream safety team, might have to be deployed.

A.22.2.2(2) Emergency response systems for flood incidents should be suitable for the scale and expected duration of a flood incident. It could require multiple agencies to engage and work cooperatively to provide a range of capabilities that might include, but not be limited to, the following:

(1) Obtaining environmental information about the flood and its sources
(2) Warning and informing members of the public
(3) Evacuating affected person
(4) Managing vulnerable persons
(5) Dealing with mass casualties
(6) Arranging mass care
(7) Arranging mass decontamination
(8) Dealing with mass fatalities
(9) Arranging domestic animal rescue
(10) Arranging wide area searches for missing persons
(11) Assessing infrastructure impacts
(12) Evaluating public health issues
(13) Evaluating utilities

The geographic scale of the incident might require suitable scaled emergency response systems at the following levels:

(1) Local, municipal, county
(2) Regional/mutual
(3) State
(4) Federal

A.22.2.2(3) Incident management systems for flood incidents need to be scalable to meet the requirements of flood incidents that might extend across political and jurisdictional boundaries. Responder safety is a key priority, and the nature of flooding incidents often requires responders to operate remotely for extended periods.

A.22.2.2(4) Hazards present in floods include water-related hazards, but the scale and nature of the hazards might be compounded by the flood. Additional hazards can also be present depending on the environment.

A.22.2.2(5) Flood types, usually classified by their source and pathway, include the following:

(1) Fluvial (river)
(2) Pluvial (rainfall)/surface water
(3) Groundwater
(4) Storm surge/tide surge
(5) Urban
(6) Snow-melt
(7) Man-made dam failures

Flood types are also categorized by the speed of the event:

(1) Flash floods (typically short notice river- or rain-related flood events)
(2) Slow rise events (some prewarning provided)

A.22.2.2(6) Flooding incidents are typically characterized by phases, which include the following:

(1) Preflood phase (no flooding yet)
(2) Rapid water rise phase
(3) Slow water rise phase
(4) Static water level phase
(5) Receding water phase
(6) Termination and recovery phase

These phases can vary in duration, and each phase might require different capabilities to operate safely.

A.22.2.2(9) Floods have long-term consequences for those affected. Responding organizations should be aware of the impact — often for extended periods — on the following areas:

(1) Social
(2) Economic
(3) Political

A.22.2.2(10) Search marking systems need to be usable in the flood environment, and the structural collapse marking systems might not be easy to implement for some of the following reasons:

(1) Varying water levels can hide markings during follow-up search activities.
(2) Paint- and poster-based systems can be difficult to apply reliably in wet conditions or to wet surfaces.
(3) Buildings and structures might be re-occupied after search activities, and marking systems can adversely affect the cost to return the building to normal use.

A.22.3.3 Flood incidents will often include a range of water environments, from shallow still water to high-energy, high-volume water environments.

A.22.3.5(3) Flood search and rescue incidents at the operations level might require a range of different types of watercraft and capabilities, but their scope of use should be limited to lower risk and still water environments with simple techniques. Helm- and crewmembers might be assigned a range of flood-related tasks, and they should be aware of the impact of these tasks on boat and crew safety.

A.22.3.5(4) In flood-affected areas, the usual signs, aids, and routes used to move through the area might be difficult or impossible to use. Responders should be able to navigate and report their position using a range of aids such as maps, aerial photographs, and GPS systems.

A.23.1.2 Nonstandard tower structures include variations such as water towers, wind turbines, concrete towers, silos, flare stacks, radar structures, wooden poles, portable towers, tower cranes, and so forth.

A.23.2.1 "Timely" in this case is not intended to refer to the kind of response capability that might be achieved through on-site, standby or co-worker assisted rescue, but is intended to emphasize that an organization who claims response capability should be able to get en-route with appropriate equipment and personnel without delay. In other words, it shouldn't take an extra 30 minutes after the initial callout to activate the Tower Response Unit.

A.23.2.2 Training should address the process of achieving and maintaining control of the site and the perimeter, whether at awareness, operations, or technician level. This control might include management of all civilian and nonemergency personnel and establishment of operational zones and site security.

A.23.2.3 Hazards associated with tower rescue operations can vary widely depending on the type and purpose of the tower, age, and structural integrity of the tower, location of the tower, environmental conditions, and other factors. The AHJ should consider the following potential hazards and, to help provide for their safety, ensure that members have the ability to recognize potential hazards that they could encounter:

(1) *Type of Structure.* Towers can be guyed, self-supporting, monopole, or non-standard structures. In any case, condition of all connections, including foundation and anchor point(s), are key to safety. Rescuers should be trained to examine the tower for any condition(s) that might compromise its structural integrity.
(2) *Environmental Hazards.* Depending on the specific environment, there are many dangers that pose hazards to responders. Responders can be exposed to such things as insect bites and stings, poisonous plants, exposure injuries (cold and heat), lightning, sunburn, dangerous wildlife, and so forth. Special care should be taken when responding to towers in remote or wilderness locations.
(3) *Purpose of Tower.* Towers can be used to support communications equipment, electrical lines, or other things. Responders should pay special attention to what equipment the tower supports and what specific additional hazards might exist as a result, including electrical hazards (including inductive current hazards associated with metal structures on or near AM broadcast towers), EMF radiation, and so forth.

A.23.2.3.1 Tower incidents involve unique potential hazards and circumstances, and responders who might be exposed to such an environment should first acquire specialized training directly from a competent tower trainer who is knowledgeable and experienced in the hazards and access methods specific to towers.

A.23.2.5 Tower rescue personnel can be exposed to various electrical hazards such as the following:

(1) Inadvertent re-energization of transmission lines through contact with a live line
(2) Electrical relay cycling due to resistive load variations
(3) Induced voltage from parallel lines

Responders should work closely with the utilities involved to be made aware of, and to mitigate, these and other hazards.

A.23.3.1.2 Significant exposure hazards aside from those presented by a fall could exist to rescuers as a result of work in close proximity to tower structures and components. These can include, but are not limited to, non-ionizing radiation (e.g., EMF and RF) energy as well as mechanical and electrical power sources. Organizations operating at the Awareness level should be adequately taught to recognize and avoid these types of hazards.

Various types of non-ionizing radiation can be hazardous to humans in different ways. Near ultraviolet, visible light, infrared, microwave, radio waves, and low-frequency RF (longwave) are all examples of non-ionizing radiation. Far ultraviolet light, X-rays, gamma-rays, and all particle radiation from radioactive decay are all considered to be ionizing. Non-ionizing radiation poses a potential threat to rescuers from thermal burns and irreversible tissue damage, which might not be felt or recognized until after damage occurs.

Awareness level rescues can be performed by means such as ladders or aerial devices commonly used by the organization. Special training is required for use of these methods.

A.23.3.2(7) Some of the hazards associated with tower emergencies can be found in the Job Hazard Analysis and can include:

(1) Site access
(2) Awareness and adherence to signage (electrical, RF, etc.)
(3) Adherence to the Site Work Plan (if site workers have one)
(4) Type of tower structure

(5) Structural integrity of the tower
(6) Guy wires
(7) Gates and fences surrounding the tower
(8) Buildings on site (electrical, storage, etc.)
(9) Availability of climbing path (ladder, pegs, or structure)
(10) Climb path obstructions
(11) Ground obstructions (open pits, ditches, vats, tanks, and other hazards)
(12) Stored materials (stacked steel, concrete, lumber, and barrels)
(13) Dangerous Goods and/or Hazardous Materials (DGHM) (solvents, fuels, and oils)
(14) Cranes, gin poles, and other machinery
(15) Toxic plant/animal hazards
(16) Biohazards (bacteria, viruses, or fungi)
(17) Environmental hazards (heat, cold, high winds, rain, snow, or sleet)
(18) Radio Frequency (RF) hazards (use of an RF monitor at all times)
(19) Electrical hazards
(20) Lack of familiarity with safety equipment and tools used by tower workers
(21) Wet paint

A.23.4.3 A plan should be devised in advance for procurement of additional, more experienced, specialized, or highly trained resources.

A.23.4.3.1(1) The size-up should include, but not be limited to, the initial and continuous evaluation of the following:

(1) Scope and magnitude of the incident, including whether it is a rescue or recovery operation
(2) Assessment of time required
(3) Assessment of staffing needs
(4) Specific environmental factors involved
(5) Integrity and stability of the environment involved
(6) Number of known/potential victims
(7) Weather (current and forecast)
(8) Urgency (based on the type of known/potential victims)
(9) Available/necessary resources
(10) Information about the physical and mental status of the subject, including whether the subject is authorized to be on the tower

A.23.4.3.1(2) This includes ensuring 100 percent fall protection at all times.

A.23.4.3.1(4) Ongoing assessment of hazards should be performed during the course of the rescue. Changing conditions can have a profound effect on hazards such as corrosion, foundation, fasteners, anchor bolts, grounding, guy wires, and weep holes. In addition, RF and electrical hazards can change over time.

A.23.4.3.1(5) Resources can include, but are not limited to, the following:

(1) Tower owners/operators
(2) Installed equipment owners/operators
(3) Helicopter short haul rescue resources
(4) Crane equipment
(5) Rope rescue specialists
(6) Telecommunications/RF specialists
(7) Electrical hazard/EMF specialists
(8) Trench rescue specialists
(9) Vehicle/machinery rescue specialists
(10) Tower maintenance companies/technicians
(11) Emergency incident management teams
(12) Lightning detection equipment

A.23.4.3.1(13) The ability to discern limitations in accessing and/or evacuating should be based on the following:

(1) Individual and team expertise
(2) Qualified personnel available
(3) Ability to communicate from the location of the subject
(4) Anticipated staffing and time

A.23.4.5(4) Rescuers should demonstrate the ability to connect energy absorbing lanyards to the tower and to their harness D-Ring, use energy absorbers for fall arrest, limit free fall, reduce swing fall, protect lanyards from abrasive or other damaging surfaces, calculate clearance requirements, and describe common hazards and mistakes.

A.23.4.5(5) Tower rescuers should demonstrate the ability to properly connect positioning lanyards to the tower and to their harness D-Ring, use lanyards for positioning, limit fall distance, reduce swing fall, protect lanyards from abrasive or other damaging surfaces, calculate clearance requirements, maintain 100 percent connection during transfers, and describe common hazards and mistakes with these devices.

A.23.4.5(6) Tower rescuers should demonstrate the ability to use a properly installed SRL that is connected to an overhead anchorage connector, climb up and down the tower structure while connected to an SRL, descend rope while connected to an SRL, calculate and maintain required clearances, and describe common hazards and mistakes with these devices.

A.23.4.5(7) Tower rescuers should demonstrate the ability to analyze and use a properly installed vertical lifeline for fall arrest and for positioning, select and install an appropriate rope grab on a lifeline, ascend and descend a ladder while connected to a vertical lifeline and rope grab, park a rope grab, calculate and maintain required clearances, and describe common hazards and mistakes with these devices.

A.23.4.5(8) Tower rescuers should demonstrate the ability to analyze and use a cable-type ladder climbing system as well as a vertical-rail type ladder climbing system. They shall demonstrate the ability to select an appropriate fall arrester for a given system, inspect and install the fall arrester on the host cable or rail, ascend and descend while connected to a ladder climbing safety system, prevent line entanglement, maintain 100 percent connection during transitions, calculate and maintain required clearances, and describe common hazards and mistakes with these devices.

A.23.4.5(9) Tower rescuers should demonstrate the use of a pre-climb checklist process to include review of the site JHA before climbing, plan a climb, select appropriate fall protection for a given climb, consider the safest route for a climb, assemble necessary equipment, visually assess the structure, assess the weather, and perform equipment inspections.

A.23.4.5(10) Tower rescuers should demonstrate the ability to climb a ladder that is mounted to a tower, as well as the ability to climb tower pegs. It should be demonstrated that they are able to climb under control, climb within their ability, always maintain three points of contact, rest during a climb, use skeletal climbing techniques (rather than muscle), maintain 100 percent tie-off during ascent and descent, and maneuver within 6 ft (1.828 m) of a fall hazard.

A.23.4.5(12) Rescuers should demonstrate the ability to preplan a rescue for a given tower site, as well as the ability to perform a rescue that has been preplanned. This includes rigging with consideration to the tower structure and safely accessing an incapacitated subject per the preplan. It also includes working within a preplan to connect to and transfer an incapacitated subject to a rescue system, releasing a subject from different types of fall protection (including vertical lifeline, SRL, force absorbing lanyard, and positioning lanyard), raising the subject at least 10 ft (3.1 m), lowering a subject to ground from a position at least 50 ft (15.2 m) above grade, and keeping the subject away from the structure during lowering.

A.23.5.1 Members of an organization at the technician level should be adept and experienced at every skill required of subordinate personnel. Technician-level organizations should have the capability to address any potential operation that falls within their jurisdiction. To accomplish this, members of these organizations should be personally adept at wilderness skills, travel, and operations in the wilderness setting.

A.23.5.3 Such an operational plan should be based on the hazard identification and risk assessment performed according to Section 4.2, available resources, environmental influences and conditions, and the urgency of the situation. The implemented plan should involve planning techniques including, but not necessarily limited to, the following:

(1) Determining the urgency of the incident
(2) Developing a subject profile
(3) Designing, developing, and establishing appropriate rescue strategy and tactics
(4) Sourcing and securing the necessary resources
(5) Considering the effects of prolonged suspension on both subject and rescuer(s)
(6) Demobilizing personnel and facilities
(7) Documenting the incident properly

A.23.5.3(4) Non-standard anchorages are any anchorage that is not specifically designed and specified as an anchorage. Rescuers operating at the technician level must be capable of effectively assessing available appurtenances on different types of towers for use as anchorages.

A.23.5.3(6) The rescuer must be capable of climbing the structure of the tower itself, without benefit of a ladder. In addition, the rescuer must also be able to effectively protect himself or herself from a fall using a type of fall protection that is carried (for example, twin lanyards).

A.23.5.3(7)(c) Horizontal manipulation can be required where it is necessary to evacuate a subject from a tower with a cross-arm or to protect a subject from a hazard that exists in the vertical path.

A.23.5.5(1) Rescuers should demonstrate the ability to properly use an energy absorbing lanyard for safety while ascending/descending/traversing a tower.

A.23.5.5(2) Tower rescuers should demonstrate the ability to properly assemble and install a horizontal lifeline (including tensioning) and to supervise another's use of a horizontal lifeline.

A.23.5.5(3) Tower rescuers within the technician-level organization should demonstrate the ability to climb the tower structure (not just a ladder) under control and within their ability, always maintain three points of contact, rest during a climb, use skeletal climbing techniques (rather than muscle), maintain 100 percent tie-off during ascent and descent, and maneuver within 6 ft (1.828 m) of a fall hazard.

A.23.5.5(5) Rescuers should demonstrate the ability to quickly and efficiently determine appropriate rescue methods for a tower for which rescue has not been preplanned. This includes selection of rigging/rescue techniques appropriate to the tower structure, selecting and rigging anchorages specific to a tower, safely accessing an incapacitated subject, connecting to and transferring an incapacitated subject to a rescue system, releasing a subject from different types of fall protection (including vertical lifeline, SRL, force absorbing lanyard, and positioning lanyard), raising the subject at least 10 ft (3.1 m), lowering a subject to ground from a position at least 50 ft (15.2 m) above grade, and keeping the subject away from the structure during lowering.

A.24.1.1.5 This standard includes requirements for fall prevention rope and equipment for emergency services during rescue, firefighting, and other emergency operations, or during training. It does not include requirements for fall protection for employees working at height in general industry or the construction and demolition industry.

A.24.1.2.1 Rescue operations are hazardous activities. It is the responsibility of the fire department to obtain expert instruction and to take adequate safety precautions based upon manufacturers' recommendations. Training should include use techniques and maintenance procedures — including properties of life safety rope, escape rope, water rescue throwline, life safety harnesses, belts, manufacturer-supplied eye terminations, moderate elongation laid life safety rope, belay devices, and auxiliary equipment — and deployment techniques of this equipment.

A.24.1.3.4 Fall factors (as illustrated in Figure A.24.1.3.4) are calculated by dividing the distance the person attached to the rope will fall by the length of the rope between the person and the rope anchor or belay. Thus, a 305 mm (1 ft) fall on a 150 mm (½ ft) rope would be a fall factor of 2.0; a 305 mm (1 ft) fall on a 305 mm (1 ft) rope would be a 1.0 fall factor; a 305 mm (1 ft) fall on a 1.12 m (4 ft) rope would be a 0.25 fall factor; and a 305 mm (1 ft) fall on a 12.2 m (40 ft) rope would be a 0.025 fall factor. Note as well that a 7.6 m (25 ft) fall on a 30.5 m (100 ft) rope is also a 0.25 fall factor. This formula assumes the fall takes place in free air without rope drag across building edges or through intermediate equipment.

When fall factors of greater than 0.25 are anticipated, such as are possible in lead climbing, dynamic ropes specifically designed for climbing should be considered. Only ropes certified to an appropriate climbing rope standard (i.e., UIAA, CE, etc.) are appropriate for this use. Dynamic climbing ropes should be stored, maintained, inspected, and use-logged in a manner similar to that required for static/low-stretch rope. Such operations are outside the scope of this document. A fall factor of 0.25 is the maximum considered for NFPA 1983.

Recent testing indicates that the formula for calculating fall factors might not translate perfectly from dynamic ropes to the more static design ropes used for fire service operations.

A.24.2.7 From time to time the NFPA has received complaints that certain items of fire and emergency services protective clothing or protective equipment could be carrying labels falsely identifying them as compliant with an NFPA standard.

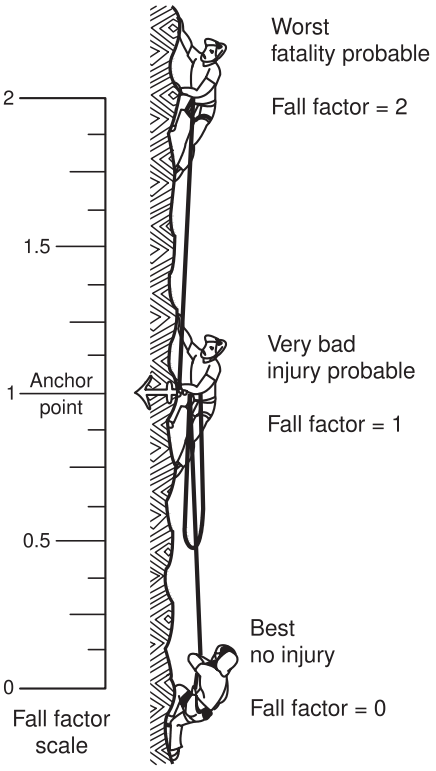

FIGURE A.24.1.3.4 Fall Factor.

The requirement for placing the certification organization's mark on or next to the product label is to help ensure that the purchaser can readily determine compliance of the respective product through independent third-party certification.

NFPA advises those purchasing life safety rope or equipment to be aware that for life safety rope or equipment items to meet the requirements of Chapters 24 through 28, they must be certified by an independent third-party certification organization. *In addition, the item must carry the label, symbol, or other identifying mark of that certification organization.*

A life safety rope or equipment item that does not bear the mark of an independent third-party certification organization is NOT COMPLIANT with NFPA 1983, even if the product label states that the item is compliant!

For further information about certification and product labeling, see Chapters 24 and 25 of this standard. Also, the definitions for *certification/certified*, *labeled*, and *listed* in Chapter 3 of this standard should be reviewed.

Third-party certification is an important means of ensuring the quality of emergency services protective clothing and equipment. To be certain that an item is properly certified, labeled, and listed, NFPA recommends that prospective purchasers require appropriate evidence of certification for the specific product and model from the manufacturer before purchasing. Prospective purchasers should also contact the certification organizations and request copies of the certification organization's "list" of products certified to the appropriate NFPA standard. This "listing" is a requirement of third-party certification by this standard and is a service performed by the certification organization.

All NFPA standards on fire and emergency services protective clothing and equipment require that the item be certified by an independent third-party certification organization and, as with Chapters 24 through 28, all items of fire and emergency services protective clothing and equipment must carry the label, symbol, or other identifying mark of that certification organization.

Any item of protective clothing or protective equipment covered by an NFPA standard that does not bear the mark of an independent third-party certification organization is NOT COMPLIANT with the appropriate NFPA standard, even if the product label states that the item is compliant!

A.24.3.1 The certification organization should have sufficient breadth of interest and activity so that the loss or award of a specific business contract would not be a determining factor in the financial well-being of the agency.

A.24.3.5 The contractual provisions covering certification programs should contain clauses advising the manufacturer that if requirements change, the product should be brought into compliance with the new requirements by a stated effective date through a compliance review program involving all currently listed products.

Without these clauses, certifiers would not be able to move quickly to protect their name, marks, or reputation. A product safety certification program would be deficient without these contractual provisions and the administrative means to back them up.

A.24.3.6 Investigative procedures are important elements of an effective and meaningful product safety certification program. A preliminary review should be carried out on products submitted to the agency before any major testing is undertaken.

A.24.3.7.1 For further information and guidance on recall programs, see 21 CFR 7, Subpart C, "Recalls (Including Product Corrections) — Guidance on Policy, Procedures, and Industry Responsibilities."

A.24.3.9 Such inspections should include, in most instances, witnessing of production tests. With certain products, the certification organization inspectors should select samples from the production line and submit them to the main laboratory for countercheck testing. With other products, it could be desirable to purchase samples in the open market for test purposes.

A.24.6.4 For example, this situation exists when the product is wholly manufactured and assembled by another entity, or entities, for a separate entity that puts their own name and label on the product, frequently called "private labeling," and markets and sells the product as their product.

A.24.6.5 Subcontractors should be considered to be, but not be limited to, a person or persons, or a company, firm, corporation, partnership, or other organization having an agreement with or under contract with the compliant product manufacturer to supply or assemble the compliant product or portions of the compliant product.

A.24.7.1 ISO Guide 27, *Guidelines for corrective action to be taken by a certification body in the event of misuse of its mark of conformity,* is a component of accreditation of certification organizations specified in 24.2.3 and 24.7.1 of this standard. Those paragraphs contain a mandatory reference to ISO/IEC 17065,

Conformity assessment — Requirements for bodies certifying products, processes, and services, in which ISO Guide 27 is referenced.

A.24.7.2 By definition, a hazard might involve a condition that can be imminently dangerous to the end user. With this thought in mind, the investigation should be started immediately and completed in as timely a manner as is appropriate considering the particulars of the hazard being investigated.

A.24.7.11 The determination of the appropriate corrective action for the certification organization to initiate should take into consideration the severity of the product hazard and its potential consequences to the safety and health of end users. The scope of testing and evaluation should consider, among other things, testing to the requirements of the standard to which the product was listed as compliant, the age of the product, the type of use and conditions to which the compliant product has been exposed, care and maintenance that has been provided, the use of expertise on technical matters outside the certification organization's area of competence, and product hazards caused by circumstances not anticipated by the requirements of the applicable standard. As a guideline for determining which is more appropriate, a safety alert or a product recall, the following product hazard characteristics, based on 42 CFR 84, Subpart E, "Quality Control," §84.41, are provided.

(1) *Critical*: A product hazard that judgment and experience indicate is likely to result in a condition immediately hazardous to life or health (IHLH) for individuals using or depending on the compliant product. If an IHLH condition occurs, the user will sustain, or will be likely to sustain, an injury of a severity that could result in loss of life, significant bodily injury, or loss of bodily function, either immediately or at some point in the future.
(2) *Major A*: A product hazard other than Critical that is likely to result in failure to the degree that the compliant product does not provide any protection or reduces protection, and is not detectable to the user. The phrase "reduces protection" means the failure of specific protective design(s) or feature(s) that results in degradation of protection in advance of reasonable life expectancy to the point that continued use of the product is likely to cause physical harm to the user, or where continued degradation could lead to IHLH conditions.
(3) *Major B*: A product hazard other than Critical or Major A that is likely to result in reduced protection and is detectable to the user. The phrase "reduces protection" means the failure of specific protective design(s) or feature(s) that results in degradation of protection in advance of reasonable life expectancy to the point that continued use of the product is likely to cause physical harm to the user, or where continued degradation could lead to IHLH conditions.
(4) *Minor*: A product hazard other than *Critical, Major A,* or *Major B* that is not likely to materially reduce the usability of the compliant product for its intended purpose, or a product hazard that is a departure from the established applicable standard and has little bearing on the effective use or operation of the compliant product for its intended purpose.

Where the facts are conclusive, based on characteristics of the hazard classified as indicated previously, the certification organization should consider initiating the following corrective actions with the authorized and responsible parties:

(1) Critical product hazard characteristics: product recall
(2) Major A product hazard characteristics: product recall or safety alert, depending on the nature of the specific product hazard
(3) Major B product hazard characteristics: safety alert or no action, depending on the nature of the specific product hazard
(4) Minor product hazard characteristic: no action

A.24.7.13 Reports, proposals, and proposed TIAs should be addressed to the technical committee that is responsible for the applicable standard and be sent in care of Standards Administration, NFPA, 1 Batterymarch Park, Quincy, MA 02169-7471.

A.25.1.1.13 Information could be added to the tape that applies to a particular rope, such as date of manufacture or any pertinent information useful to the purchaser.

A.25.1.2.4(1) To avoid possible damage, and possible reduction and loss of strength of the life safety rope or harness, the manufacturer should be contacted prior to disinfecting or cleaning by a method not prescribed in the maintenance procedures and retirement criteria.

Generic inspection information for some types of life safety ropes can be found in ASTM F1740, *Standard Guide for Inspection of Nylon, Polyester, or Nylon/Polyester Blend, or Both Kernmantle Rope.*

A.25.2.1.2 Information useful to the purchaser that applies to a particular line could be added to the tape.

A.25.2.1.9 See A.30.3.

A.25.2.1.12 Information useful to the purchaser that applies to a particular rope could be added to the tape.

A.25.3.1.3 See A.30.3.

A.25.4.1.1 See A.30.3.

A.25.4.1.2 See A.25.2.1.2.

A.25.4.1.9 See A.30.3.

A.25.4.1.12 See A.25.2.1.12.

A.25.5.1.3 See A.30.3.

A.25.6.1.1 Throwlines that are provided to the potential user in water rescue throwbags should include proper instructions for use of the throwbag in accordance with ASTM F1730, *Standard Guide for Throwing a Water Rescue Throwbag.*

A.25.6.1.8 See A.30.1.10.

A.25.9.1.12 For calculating the "fit height," it will be assumed the wearer has a 1015 mm (40 in.) chest.

A.25.17.2.5 The instructions can be conveyed using illustrations. Illustrations should have a minimum height of 20 mm (0.8 in.).

A.26.1.1.2 If a finish is applied to rope fiber during production, it should not interfere with safe usage of the rope due to excessive slipperiness; this characteristic should be evaluated by the purchasing organization before the rope is purchased.

A.26.4.1.1 See A.26.1.1.2.

A.26.5.1.1 See A.26.1.1.2.

A.26.6.1.1 See A.26.1.1.2.

A.26.7.1.1 See A.26.1.1.2.

A.26.9.1.3 Many life safety harness and system components that meet the requirements of this standard might not interface effectively with all systems of use and all types of life safety rope. Evaluation should be done before purchase to ensure compatibility.

Load-bearing textile materials should have strength, aging, ultraviolet resistance, abrasion resistance, and heat and cold resistance characteristics equivalent or superior to polyamides.

A.26.9.1.4 Alternative methods for finishing and securing webbing ends can be hardware capping, tucking and sewing, and coating the webbing ends with an air-drying solvent base sealant.

A.26.9.1.5 To aid the visual inspection of thread, it is recommended that the manufacturer use a thread that is of contrasting color to the webbing.

A.26.10.1.2 See TOOK OUT MANDATORY REF TO TURN ON CONTEXT RULEs.

A.26.10.1.3 See A.26.9.1.3.

A.26.10.1.4 See A.26.9.1.4.

A.26.10.1.5 See A.26.9.1.5.

A.26.22.1.6 See A.26.9.1.4.

A.26.22.1.7 See A.26.9.1.5.

A.27.1.3 Table A.27.1.3 shows comparisons of rope diameters to circumference in both millimeters and inches.

A.27.1.4 See A.27.1.3.

A.27.1.5 The thermal requirement is intended to limit melting of rope, harness, and certain other system components due to friction caused by activities such as rappelling. The thermal requirement is NOT intended to qualify these items for use during fire-fighting operations or other operations where high temperature exposures are encountered.

Table A.27.1.3 Comparison of Rope Diameter/Circumference

Diameter in Decimal (mm) Nearest 0.5 mm	Diameter in Decimal (in.)	Diameter in Fraction (in.) Nearest 1/64	Equivalent Circumference (in.)
7.5	0.295	19/64	0.93
8.0	0.313	5/16	0.98
8.5	0.335	11/32	1.05
9.0	0.354	23/64	1.11
9.5	0.376	3/8	1.18
10.0	0.394	25/64	1.24
10.5	0.413	13/32	1.30
11.0	0.433	7/16	1.36
11.5	0.453	29/64	1.42
12.0	0.472	15/32	1.48
12.5	0.492	1/2	1.55
13.0	0.513	33/64	1.61
13.5	0.531	17/32	1.67
14.0	0.551	35/64	1.73
14.5	0.570	18/32	1.79
15.0	0.590	19/32	1.85
15.5	0.610	39/64	1.92
16.0	0.630	5/8	1.98

A.27.2 See A.34.1.

A.27.2.2 See A.27.1.3.

A.27.2.3 The thermal requirement is intended to limit melting of rope, harness, and certain other system components due to friction caused by activities such as rappelling. The thermal requirement is NOT intended to qualify these items for use during firefighting operations or other operations where high temperature exposures are encountered.

A.27.4 See A.34.1.

A.27.4.2 See A.27.1.3.

A.27.4.3 See A.27.2.3.

A.27.6.2 See A.27.1.3.

A.27.7.3 See A.27.1.5.

A.27.8.1 The calculation of the minimum breaking strength of a manufacturer-supplied eye termination is derived from 85 percent of the minimum breaking strength of the host line.

A.27.9.5 The thermal requirement is intended to limit melting of rope, harness, and certain other system components due to friction caused by activities such as rappelling. The thermal requirement is *not* intended to qualify these items for use during firefighting operations or other operations where high temperature exposures are encountered.

A.27.12.5 The thermal requirement is intended to limit melting of rope, harness, and certain other system components due to friction caused by activities such as rappelling. The thermal requirement is *not* intended to qualify these items for use during firefighting operations or other operations where high-temperature exposures are encountered.

A.27.22.4 See A.27.12.5.

A.28.2.4 NFPA 1983 does not preclude a variety of rope construction types as long as the construction types meet the performance requirements of the standard. The title of CI 1800, *Test Methods for Life Safety Rope and Accessory Cords for Life Safety Applications*, indicates a particular type of rope construction; however, the elongation and breaking strength test methods contained in CI 1800 can be used for other types of rope construction.

The reference is not intended to limit the rope construction to the construction type mentioned in the title of CI 1800 or to any other single type of rope construction. The reference is only intended to refer to the testing methods for elongation and breaking strength specified in Section 7 of CI 1800 for evaluating any rope construction type for compliance with Chapters 24 through 28 (NFPA 1983).

A.28.3.3.2 The intent is to test three samples of each model per test. At the manufacturer's discretion, a new, unused sample from one test series can be used for one or more of the other test series. For example, a sample used in harness test Section 28.3 can be used to conduct harness test Section 28.4, or a new unused sample can be used.

A.28.3.8.2 The 16 kN (3597 lbf) test value selected for this static test, which employs a rigid test torso, equates to having a

dynamic force exerted on the body greatly exceeding that which is considered reasonable to survive.

A.28.3.9.2 The 16 kN (3597 lbf) test value selected for this static test, which employs a rigid test torso, equates to having a dynamic force exerted on the body greatly exceeding that which is considered reasonable to survive. The force selected for the head-down position is less than that selected for the upright position test because, in realistic emergency operations, a person falling headfirst will impact the harness with less force in the head-down position, and then be inverted and arrested, thus producing the maximum force in the upright position.

A.28.3.10.2 A lesser force is used in this test than in the rescue harness test due to the personal protective application of belts. The indicated test force is consistent with the requirements for escape rope.

A.28.3.11.2 See A.28.3.10.2.

A.28.3.13.2 See A.28.3.8.2.

A.28.3.14.2 See A.28.3.8.2.

A.28.4.3.2 See A.28.3.3.2.

A.28.5.6.1 The pin dimensions are specified within ASTM F1956, *Standard Specification for Rescue Carabiners*.

A.28.6.4.4.7.3 To be compliant with the standard, a belay device that is also intended to function as a descent control device for braking a load either before or after arresting a fall should meet the standard's requirements for a descent control device.

A.28.6.7.1 Testing is specific to the rope/device interaction and does not impact or diminish the requirements of Section 27.2. This test is independent of the test outlined in Section 27.2.

A.28.7.4.1 In most cases, the portable anchor device will be weakest at its greatest (or highest) extension. However, many devices have multiple ways they can be used. Different rigging configurations could be stronger or weaker than others. It is intended that the testing be done in the configuration specified in the manufacturer's instructions to the user that would yield the lowest strength results. For example, multiple configuration straps can be rigged in a basket, end-to-end, or choker configuration. Each configuration will likely yield different results. The minimum breaking strength reported is for the weakest configuration allowed by the manufacturer's instructions.

A.28.7.5.1 See A.28.7.4.1.

A.28.7.6.8 Test pins are used to simulate the function of carabiners to connect various products together. The radius of the test pin, where it contacts the product being tested, should match a common size carabiner used in the fire service. The pin does not have to be round as it could be necessary to have a stronger pin than is available in round stock. Regardless, the face of the pin in contact with the product being tested should have the radius referenced in the test procedure. Wire rope can be used to simulate the function of rope as it applies to the function of the device. The diameter of the wire rope should be as close as possible to the largest diameter of rope with which the device is designed to work.

A.28.7.8.5 For example, portable anchors designed to be attached to flanged rims of vessel openings would require a test base to simulate the flanged portal to which the device is designed to be affixed.

A.28.7.11.2 AISI SAE Type 01 tool steel is commonly purchased as 01 Drill Rod.

A.28.7.12.2 AISI SAE Type 01 tool steel is commonly purchased as 01 Drill Rod.

A.28.15.4.1 Where performing this test, consideration should be given to the furnace tube diameter. The furnace diameter can have an effect on the airflow of the furnace, and larger diameters can also contribute to a significant chimney effect.

A.28.15.4.1.1 The intent of the rope or webbing attachment to the eye is to minimize the introduction of variables and possible conduction of the heat from the hardware.

A.28.15.4.2.1 Good laboratory practice should dictate that the furnace temperatures be verified at the position of the rope specimen. This can be accomplished with calibration thermocouples. Furnace temperature controls and output displays might not be representative of the temperature at the position of the specimen.

A.29.4.2 For more information on recording rope history, see ASTM F1740, *Standard Guide for Inspection of Nylon, Polyester, or Nylon/Polyester Blend, or Both Kernmantle Rope*.

A.29.6.2 Electronic means is acceptable for notifying the manufacturer and the certification organization of suspected product failure.

A.30.1.1 Refer to Chapters 4 through 23 for guidance in determining the requirements for life safety rope and equipment for technical rescue incidents.

Other resources include the following:

(1) NFPA 1500
(2) NFPA 1407
(3) NFPA 1006
(4) OSHA or state occupational safety and health standards applicable to technical rescue
(5) Standards or procedures developed by the AHJ or the organization

A.30.1.2.1(1) The type of technical rescue incidents to which the organization will respond determines the choice of life safety rope and equipment having the same functional capability. In most cases, the same equipment can be used for several different types of responses. In other cases, incident location and environmental conditions might require more specialized equipment. Examples of incident types include, but are not limited to, the following:

(1) High angle rescues
(2) Low angle or over-the-bank rescues
(3) Confined space rescues
(4) Subterranean rescues
(5) Industrial rescues, including structural tower rescues
(6) Wilderness or remote access rescues
(7) Water, flood, and swift water rescues
(8) Ice rescues

A.30.1.2.1(6) Chapters 24 through 28 divide life safety rope and equipment into two designations: general use and technical use. NFPA does not establish or endorse a particular safety

factor or ratio. Rescue organizations can elect to use either technical-use- or general-use-labeled equipment based on the anticipated loads of the incident; training/skill level of responders; and the AHJ's established acceptable safety factors. What safety factor(s) is deemed appropriate might vary based on the acceptable level of risk, severity of consequences of a potential failure, types of technical rescues, and the corresponding level of operational capability of the organization. The AHJ should compile and evaluate information on the comparative advantages and disadvantages of the life safety rope and equipment under consideration. For example, an organization at the operational level performing a simple rescue might require the higher strengths offered by general-use equipment. A highly trained or specialized organization performing more complicated rescues might benefit from the lighter weight of technical-use equipment but, due to the level of training, can maintain an acceptable safety factor while increasing the efficiency of its operations. General-use equipment can provide greater durability and possibly an advantage for incidents in which the anticipated system loads are difficult to estimate.

A.30.1.2.1(7) The organization's geographic areas should include mutual aid or auto aid responses into other districts. Conditions include environmental factors that can make a rescue more difficult such as weather, terrain, vegetation, and distance from vehicular support.

A.30.1.3 The organization should take into account the following considerations in the risk and hazard assessment. While primarily considered an emergency means of egress from height for firefighters, escape capability is also appropriate for other emergency responders.

(1) Self-risk assessment.
(2) Escape situations that could occur in mutual aid and auto aid response areas. Consider type of escape situation that may occur in districts other than your own
(3) The organization's policy on staging for high rise or mid-rise structures. This will determine the length of the escape rope or webbing, whether purchased separately or as part of an escape system.
(4) The level of initial and ongoing training of the organization's personnel. This will determine the type of descent method, descent control device, and system. Different levels of training are required for the different escape devices and systems. For example, a larger-diameter escape rope is easier to grip, but it is bulkier and heavier for carrying.
(5) The type of operations conducted by the organization. For example, structural firefighting with its PPE might require a different escape system than an operation that does not have the potential for elevated temperatures but may still require emergency egress.
(6) The anticipated level of initial and ongoing training. This will determine the type of escape anchor device to be selected. A line around a solid object and secured by a carabiner is very secure but takes more time than other options. A hook or bar in the window allows for a rapid exit maneuver but is much less secure and requires a higher level of training.
(7) The compatibility of the escape system during transport, deployment, and use with the PPE worn by the organization's personnel. Evaluation of escape systems should be done with the evaluator wearing full PPE and SCBA or any other equipment normally carried.
(8) The situational use of the escape system. For example, the evaluator might want to start the escape system deployment while on knees or hands and knees.
(9) The type of structures and construction in the response area. Organizations should choose the anchor device best suited for the prevalent type of construction in their areas, such as interior anchor points, window framing of wood or brick, kinds of furniture, or exterior walkways or railings.

A.30.1.4 NFPA does not certify products. A third-party certification organization conducts the necessary evaluation and testing for certification to the applicable NFPA standard. Manufacturers cannot make a self-declaration that products meet the standard.

From time to time, NFPA receives complaints that certain items of fire and emergency services protective clothing or protective equipment could be carrying labels falsely identifying them as compliant with an NFPA standard. The requirement for placing the certification organization's mark on or next to the product label is to help ensure that the purchaser can readily determine compliance of the respective product through independent third-party certification.

NFPA advises those purchasing life safety rope or equipment to be aware that for life safety rope or equipment items to meet the requirements of NFPA 1983, they must be certified by an independent third-party certification organization. In addition, the item must carry the label, symbol, or other identifying mark of that certification organization.

A life safety rope or equipment item that does not bear the mark of an independent third-party certification organization is not compliant with NFPA 1983, even if the product label states that the item is compliant.

For further information about certification and product labeling, see Chapters 4 and 5 of NFPA 1983. Also, the definitions for *certification organization*, *certified*, *labeled*, and *listed* in Chapter 3 of this standard should be reviewed.

Third-party certification is an important means of ensuring the quality of emergency services protective clothing and equipment. To be certain that an item is properly certified, labeled, and listed, NFPA recommends that prospective purchasers require appropriate evidence of certification for the specific product and model from the manufacturer before purchasing. Prospective purchasers should also contact the certification organizations and request copies of the certification organization's list of products certified to the appropriate NFPA standard. Such a "listing" is a requirement of third-party certification by this standard and is a service performed by the certification organization.

All NFPA standards on fire and emergency services protective clothing and equipment require that the item be certified by an independent third-party certification organization, and all items of fire and emergency services protective clothing and equipment must carry the label, symbol, or other identifying mark of that certification organization.

Any item of protective clothing or protective equipment covered by an NFPA standard that does not bear the mark of an independent third-party certification organization is not compliant with the appropriate NFPA standard, even if the product label states that the item is compliant.

A.30.1.10 When life safety rope is purchased, the AHJ should ensure that the product label(s) with the information as specified in Section 25.1 is attached and remains with the rope until placed in service. When the product label is removed from the rope, the label should be retained in the AHJ's permanent rope records.

It is very important that the information on the product label(s) and the information required in Section 25.1 to be supplied by the manufacturer reach the persons who will actually be using the rope. It is useless for the supply personnel or equipment officer to remove the product label and other pertinent information and simply retain them in the rope record file. The persons who potentially will be using the rope need to be provided with all the information available. Copies of the product label(s) and other pertinent information should be maintained with the rope wherever the rope is in service awaiting use so that the potential users can consult the information.

Where life safety or escape line is purchased in long lengths and then cut by the end user agency to make several life safety ropes or escape lines, the product label(s) should be photocopied or otherwise reproduced and attached to each life safety rope when it is sent into service. The end user(s) (in a fire department it probably would be a fire company) should keep the copy of the product label(s) and any other pertinent information for reference and have the product label and other information readily available so that they can be reviewed by all potential users whenever necessary.

A.30.2.1 Typically the intended application of life safety rope is for protection of a person from fall or for actual access to or from height. While design for these applications might seem to be close, specific choices of life safety rope should be made for specific applications. Choices that the AHJ might make include, but are not limited to, material, construction, elongation, strength, diameter, weight, hand, color, and length. For example, a dynamic rope that has the ability to absorb energy safely might be more important than other qualities for protecting someone at risk of falling from height, while in a rope lowering or raising operation, a less elastic rope might be a better operational efficiency choice.

A.30.2.2 Cordage yarns typically used in life safety ropes are nylon, polyester, and para-aramids.

Nylon. Nylon for ropes comes in two types, Type 6 and Type 6,6. They have similar properties, but nylon 6,6 has less elongation and a slightly higher melting temperature (258°C) than Type 6. Type 6 nylon is often chosen if more elongation is desired *(see A.30.2.4)* and maximum strength *(see A.30.2.5)* and temperature resistance are not as important. Nylon, with a specific gravity of 1.14, is resistant to weak acids, decomposed by strong mineral acids, resistant to alkalis, resistant to organic solvents, and soluble in phenols and formic acid.

Nylon life safety ropes are very durable, usually have good handling qualities, and usually have a higher elongation percentage than other fibers. Nylon also absorbs water, resulting in increased weight and decreased strength.

Polyester. Polyester is lower in elongation than nylon, has about the same strength and temperature range as nylon 6,6, and has a specific gravity of 1.38. Polyester life safety ropes are selected if extremely low elongation is desired or the rope is expected to be used in wet conditions.

Life safety rope with a polyester sheath and nylon core has been available for several years and provides some of the advantages and disadvantages of each. Not as common and not around as long, nylon sheath and polyester core might have unique advantages for certain applications.

Para-aramids. Para-aramids include Kevlar®, Twaron®, and Technora®, among others. All of these fibers are much stronger than nylon and polyester and have very low elongation. They do not melt but decompose around 500°C. The specific gravity is over 1.39. Para-aramid ropes are selected when high temperature or flame resistance is required, often the choice for escape rope.

UHMWPE. Ultra high molecular weight polyethylene fibers include Spectra® and Dyneema®. The low melt point (150°C) of these yarns does not allow it to qualify for life safety rope, but its low specific gravity (0.97) and high strength make it a common choice for water rescue throwlines.

A.30.2.3 Rope construction is the method of assembling the yarn bundles into ropes. Different assembly types have various properties, making some constructions better than others for a particular application. NFPA 1983 does not specify any one particular rope construction type or material but provides performance requirements for a certified rope. Typical constructions found in emergency services are laid rope, double braid, and kernmantle.

Braid. A rope or textile structure formed by a braiding process. [**CI 1202**, used with permission]

There are many subcategories of braids, each having its own advantages and disadvantages for use in rescue.

Braid Pattern. A description of the manner in which the strands of a braided rope are intertwined. A plain (diamond) pattern is when one strand (or multiple strand) of one direction of rotation about the axis passes over one strand in the opposite direction and it in turn passes under the next strand of the opposite direction. A twill pattern is when one strand (or multiple strand) of one direction of rotation about the axis passes over two strands of the opposite direction and it in turn passes under the next two strands of the opposite direction. [**CI 1202,** used with permission]

The diamond braid pattern is more common in life safety rope applications, but either pattern is permitted by NFPA 1983.

Hollow Braid. A single braided rope having a hollow center consisting of multiple strands which may be braided in a plain or twill pattern. A 12-strand braid is commonly used. [**CI 1202,** used with permission]

Hollow braids are the simplest of all braids to make. Their low strength compared to other constructions and soft hand make them seldom used in life safety rope applications, but they are found in utility fire service applications such as ladder halyards. Hollow braids lack the protective feature of a load-bearing core protected by an outer braid.

Double Braid. A rope constructed from an inner hollow braided rope (core) surrounded by another hollow braided rope (cover). Also called Braid-on-Braid, 2 in 1 Braid. [**CI 1202,** used with permission]

Double braids were popular with some fire rescue operations in the past. Their typical easy hand runs well in rigging gear

such as pulley systems. Because the generally looser construction is easier to snag and abrade on rough surfaces, the double braids are no longer a selected as a life safety rope for fire ground or remote rescue operations.

Solid Braid. A cylindrical braid in which each strand alternately passes under and over one or more of the other strands of the rope while all strands are rotating around the axis with the same direction of rotation. On the surface, all strands appear to be parallel to the axis. [**CI 1202,** used with permission]

Solid braid is one of the more economical methods of manufacturing ropes, and many utility ropes in smaller diameters can be found in this construction style. They are often seen in water rescue ropes and hardware store general-duty small ropes.

Laid. Ropes made by twisting of three or more strands together with the twist direction opposite that of the strands. [**CI 1202,** used with permission]

Laid ropes are probably one of the earliest tools known. First made of natural plant fibers such as grass, they are now available in modern fibers like nylon and polyester. It is important to note any wear on the outside fibers because they are all twisted together without an independent inside core, unlike kernmantle and double braid constructions. Laid ropes are higher elongation than many other construction types. Elongation provides energy absorption in a fall but also makes for more work in haul and lower systems due to the same stretch. The built-in twist in laid ropes can also be a management problem for the user in fire rescue operations.

Kernmantle. A rope design consisting of two elements: an interior core (kern) and an outer sheath (mantle). The core supports the major portion of the load; and may be of parallel strands, braided strands or braided. The sheath serves primarily to protect the core and also supports a portion of the load. There are three types: static, low stretch and dynamic. [**CI 1202,** used with permission]

Typical rescue kernmantle construction is a braided sheath over a continuous parallel core. This design provides relatively low elongation due to the parallel core strands and excellent protection of the core fibers from the covering sheath. Various models are available with thicker or thinner sheaths, tighter or looser sheaths, and low or high twist parallel core strands. Additionally, many different choices of materials and blends of materials are available. Most life safety ropes today are of kernmantle construction.

A.30.2.4 Elongation is the ratio of the extension of a rope, under an applied load, to the length of the rope prior to the application of the load expressed as a percentage. Rope increases in length as the load on the rope increases. [**CI 1202,** used with permission]

A rope's ability to elongate is important in that elongation can be a critical part of reducing the impact forces on the user and the system in a fall. Fall factors are a means of describing the relationship of the length of a fall to the amount (length) of rope available to absorb the fall's energy. Should a user fall from his or her position, rope anchored high above the user will provide a much lower fall factor than a rope of the same length anchored below the user.

NFPA 1983 requires manufacturers to provide users with the elongation of certified ropes at 1.35 kN (300 lbf), 2.7 kN (600 lbf), and 4.4 kN (1000 lbf). This information can provide a good comparison between one rope and another as to their elongation to load curves for typical working loads. The more a rope elongates, the more energy it will absorb in a fall. Too much elongation can cause problems such as rope bounce when lowering, excess resets in haul systems, and loss of control in mid-face loading in a pick-off rescue. Typical fire-rescue applications choose ropes classified by the Cordage Institute as either static or low stretch.

Static Rope. A rope with a maximum elongation of 6% at 10% of its minimum breaking strength. [**CI 1202,** used with permission]

Static life safety rope is usually selected when rope stretch will be a problem. This can occur with high lines, guiding lines, long rappels, or rope systems with a long length of rope involved. Static ropes allow a more efficient mechanical advantage haul system because less stretch must be removed from the rope after each reset of the system.

Low Stretch Rope. A rope with an elongation greater than 6% and less than 10% at 10% of its minimum breaking strength. [**CI 1202,** used with permission]

Low stretch life safety rope provides a balance between not too much stretch during use and some elongation to absorb energy should a shock load occur to the system. There is always a trade-off in arresting a falling rescuer or litter — the less distance the fall, the higher the impact force but also the less chance of hitting something on the way down.

Moderate Stretch Rope. A rope with elongation greater than 10% and less than 25% of the rope's minimum breaking strength. [**CI 1805,** used with permission]

Moderate stretch rope is not classified as life safety rope according to NFPA 1983 because of the greater amount of elongation. Moderate stretch rope is classified as a special-use rope defined by NFPA 1983 as moderate elongation life-saving rope. The greater elongation allows for a lower impact force, but there is more movement when the rope is loaded.

High Stretch Rope. A rope with an elongation greater than 25% at 10% of the MBS. [**CI 1805,** used with permission]

Dynamic Rope. A very high elongation rope compared to static and low stretch ropes. Requirements for this rope are based on the UIAA climbing rope standard for mountaineers and are typically outside the scope of NFPA 1983. Dynamic ropes are used to lower the impact load on a climber's body, the anchors, and the equipment in a roped fall. One use in the fire service is for belaying a rescuer approaching a person who is threatening suicide by jumping from a height.

A.30.2.5 Life safety rope certified to NFPA 1983 must meet a minimum performance level for the intended use. The MBS is a statistical calculation that provides a number in which the user can have confidence that all new ropes of that design will meet or exceed that MBS. The MBS test is a best case test method, and real field applications are not likely to get the same strength.

Edges, knots, age, wear, temperature, moisture and many other factors can lower the real breaking strength of a rope in use. Some factors will change the strength, as when a knot is untied or replaced with a different knot, making the rope

stronger or weaker. Other factors such as wear or chemical exposure can cause permanent loss of strength.

Simply specifying "the strongest rope available" is problematic because strength is directly proportional to rope diameter. As the diameter increases, so does the weight of the rope. An understanding of the organization's system safety factor will determine what strength specification will be sufficient when force multipliers, knot efficiency, possible dynamic loading, and the other system components are considered.

A.30.2.6 For NFPA 1983, the actual diameter of a certified rope is determined according to Section 9.1 of CI 1800, *Test Methods for Life Safety Ropes and Accessory Cords for Life Safety Applications*, and then rounding to the nearest 0.5 mm ($\frac{1}{64}$ in.).

Equipment such as pulleys, ascenders, and descent control devices often work correctly only when matched with the correct diameter rope. In some combinations, a very small difference in rope diameters will change the performance of the other devices. The organization must take care to make sure the ropes purchased match the other devices in service or expected to be purchased in the future.

Larger diameter ropes are easier to grip by hand, but they also are heavier.

A.30.2.7 The weight per unit length of a rope is one indicator of the amount of material used to produce a rope when comparing one rope construction to another. Generally speaking, a rope with a higher per meter weight will be stronger than a rope weighing less per meter when both are made from the same material. However, care should be taken with such an assumption because rope might also be weighted by other material.

Consideration needs to be given to the length and the diameter of a rope and the weight of a given rope length for deployment and transportation to the site. Bigger is not necessarily better if a rope has to be carried long distances and an adequate safety factor could be provided with a smaller diameter rope.

A.30.2.8 The feel of flexibility and smoothness of a rope when tying knots or running it through equipment such as descent control devices and pulleys is often referred to as "hand." While a soft hand makes knots in ropes easier to tie, they may not untie after loading as easily if the hand is too soft. Ropes with a soft hand can also overly flatten out over edges and when running through descent control devices and pulleys.

Ropes with a very stiff hand have better abrasion resistance and flatten less in devices, and loaded knots might be easier to untie. The correct choice could be between these extremes, depending on the devices being used with the rope and the environment it will be rigged in.

A.30.2.10 The most common use of color is to differentiate life safety rope while it is in service. For example, the main line would be one color and the belay line a different color — the rope that requires action can be quickly identified by the color.

Other choices for the use of color could be to designate different lengths of rope used by the organization or to indicate the year of purchase.

A.30.2.11 Length is a critical specification in that ropes must reach the ground (or location of the intended load) with enough length to tie into anchors, build haul systems, and allow for operational personnel at the top and bottom to be back from any hazard zone. While ropes can be knotted together to extend the length, passing a knot through a device or system is time consuming and should be avoided if sufficiently long ropes can be deployed. Shorter length ropes can also be carried to aid in rigging.

Organizations performing hazard assessments for their jurisdiction must consider all tall objects from which a rescue might be needed, not just high-rise or multistory buildings. Bridges, dams, radio towers, tunnels, ventilation shafts, and the like are all potential sites for rope rescue. Having adequate rope lengths and numbers are key to a smooth and safe operation. Some rescues off high objects are often best run from the ground requiring more than double the height of the object to operate successfully.

Jurisdictions that have a variety of heights should consider carrying different lengths of rope. For a rescue from a lower height, a shorter rope will reduce the bulk and weight needed to be carried to the rigging area. For rescues from higher structures, longer ropes allow a smoother rescue by avoiding a knot pass through a device or system.

A.30.2.12 NFPA 1983 requires the fiber of a life safety rope to have a melting point of not less than 204°C (400°F) when tested to ASTM E794. The thermal requirement limits damage to the rope due to heat generated by the friction of the life safety rope running through a descent control device or over edges.

The performance of nylon and polyester life safety ropes will begin to degrade at temperatures below the melting point of the fibers. For that reason, use intended on the fire ground or near high temperatures require some means of protecting the rope.

A.30.2.13 There are many factors to consider in the design of a rope. The AHJ should review, inspect, and compare a rope's interaction with the organization's equipment in expected conditions of use. No organization should assume that, given various types of ropes, all rope-related equipment will function or react the same. Rope sheath material, core material, and their interaction with each other should be considered. Rope performance can vary when materials used in the construction of the sheath differ from those used in the core.

Sheath designs, including the braid pattern, number of yarn carriers, and the tightness of the sheath, are critical elements to consider for the interface between the rope and various items of hardware, such as descent control devices, pulleys, ascenders, rope grabs, and belay devices. The organization must evaluate the interaction of its equipment to determine favorable performance for various styles of ropes and their materials and construction features.

Also of importance is the hand and abrasion resistance of the rope. The number of carriers and the tightness of the sheaths braid can affect the hand and the abrasion resistance of the rope. These characteristics should be evaluated by the AHJ to determine the desired performance of a rope.

A.30.3 When escape line is purchased, the purchaser or the AHJ should ensure that a product label with the information as specified in Section 25.2 is attached and remains with the line until placed in service. This label should be retained either in the AHJ's line records or with the user of the line for reference.

Escape line is intended *only for emergency self-rescue situations* and cannot be used for other line rescue situations. Escape line is designed for one emergency use only and should be destroyed after use. This does not include use for training where lines are not subjected to excessive conditions such as stress, impact-loading situations, abrasion, kinking, heat, and exposure to chemicals and other products.

Escape line is intended to be carried by a firefighter or other emergency services personnel so that it will be available in unanticipated situations from which self-rescue using the line is the only option. Therefore, the escape line should be carefully stored and periodically inspected by a qualified person to ensure status and condition of the line. During inspection, if there is any doubt as to the suitability of the escape line for use, it should be destroyed immediately and replaced.

A.30.3.1 Escape rope is part of an assembly worn by a rescuer and used to descend from a position of height to safety at a lower level. An escape assembly might have an escape anchor device, an escape rope, and an escape descent control device connected to a belt or harness or integrated into a SCBA or the turnout jacket or pants. The assembly might be carried in a pocket or bag attached to the rescuer. The organization should evaluate through practical testing to ensure that all the components are compatible and function as intended. For selection criteria on the other components that might be a part of the escape assembly, see Sections 30.6, 30.9, and 30.18.

A.30.3.1.1(1) Exposure to elevated temperatures degrades the strength of the any rope, which decreases the time that the rope is able to support the user. Larger diameter ropes provide a greater resistance to failure at elevated temperatures. Greater bulk takes longer for the effect of heat to weaken the rope, allowing more time to complete the egress. The trade-off is greater bulk and weight.

In general, fire escape rope should be used when higher temperatures are anticipated. Escape rope can be chosen when temperatures not requiring PPE for heat are anticipated.

It should be noted that no fiber is fire proof and that fire escape rope, while having a higher working temperature, is still susceptible to the high temperatures typically found in burning structures.

A.30.3.1.1(2) The termination at the anchor end of the rope determines how the user will connect the rope to a structure for a secure anchor that will support the user's weight. The end of the rope can be attached to a hook, bar, or carabiner using a knot or sewn termination. Either type of termination reduces the strength of the rope by some factor.

A.30.3.1.1(3) Not all ropes are tested or certified with all types of descent control devices. The organization should determine that the rope selected is compatible with the type of descent control device selected. The manufacturer of the device should be able to supply the information as to which specific ropes have been determined to function and consulted as to what type of rope was tested or certified with the selected descent control device.

A.30.3.1.1(4) This is a function of the descent control device selected, the diameter of the rope, and the "gripping" surface of the rope. Proper technique for most escape descent control devices includes operating the device with one hand while the other hand grips the rope. The tension required with the hand gripping the rope depends on the particular descent control device. The more tension that must be held by the hand on the rope, the more important is the ability to grip the rope.

A.30.3.1.1(5) When making an emergency escape, there is a high probability that the user will impact the escape rope and system in an attempt to exit quickly. It is important that the system or components chosen will limit the impact forces on the user, the anchors, and other components to limit user injury and prevent a failure of the system.

There are a number of ways this can be addressed in the design of an escape system, including the following:

(1) Choosing an escape rope with sufficient elongation to absorb the expected impact force
(2) Choosing a descent control device that slips at approximately 8 kN to limit the forces on the system
(3) Choosing an escape system with a force limiter or absorber built into the system

A.30.3.1.1(6) If the AHJ determines that the body belay or similar method is to be used as the escape or bail-out method of the organization, it is important to recognize the wide range of user gripping abilities, user fatigue, and environmental conditions presented by using this technique. Organizations should evaluate these factors and study the effectiveness of the body belay technique in their organization and the operational risk factors.

A.30.3.2.1(1) Due to the bulk and weight of an escape system, only a certain amount of rope can reasonably be carried. The height of structures in the response area help determine a minimum length of rope for the escape system. If the structures are several stories high, the protocol could be to evacuate to a lower, safe level rather than completely to the ground.

A.30.3.2.1(2) Consideration should be given for additional weight and bulk during daily operations. For example, on the firefighter the escape rope might be carried or worn in the turnout pants, in the turnout coat, on the SCBA, or on a belt. The location and the packaging affect the user's ability to deploy the rope and should be evaluated while the user is wearing full equipment, while the user is in different positions such as kneeling, and while the user is wearing SCBA and mask. The location of the rope cannot not interfere with the use or performance of other PPE worn by the user.

A.30.3.2.1(4) Because of the smaller diameter of escape ropes and the type of fibers that might be selected, fire escape ropes are not as durable as life safety ropes. Generally, escape ropes should have minimal use, such as one or two rappels, to verify the performance and the user's ability to operate the escape assembly, then annual training. If the organization's protocol calls for greater use, then a larger diameter rope should be selected to increase durability.

A.30.4 Life safety harnesses fulfill a variety of roles for both rescue and fire ground operations. Specialized harnesses might be required for different types of operations and levels of operational capability. Some harnesses are specialized, while other designs are suitable for a wider range of uses. Following is a list of specialized harnesses:

(1) An escape harness is intended to be worn during elevated operations and used with an escape system for an emergency descent to a lower position of safety.
(2) A rescue harness is designed to provide a safe working platform for a rescuer supporting the load of a victim.

(3) A travel restraint harness is a fall protection harness that prevents the wearer from reaching a position where a fall might occur. The rescue version of a travel restraint harness will have travel restraint attachment points.
(4) A fall arrest harness is a fall protection harness that stops a fall and supports the wearer until he or she can self-rescue or be retrieved by others. A rescue harness will have fall arrest attachment points.

A.30.4.1 NFPA 1983 divides harnesses into two classes, Class II and Class III:

(1) A Class II life safety harness fits around the waist and around the thighs or under the buttocks. Sometimes referred to as a "sit" or "seat" harness, it is the primary load-bearing surface for both the Class II and Class III designs. A Class II harness provides greater mobility for some rescues and is all that is required for low-angle rescue.
(2) A Class III life safety harness fastens around the waist, around the thighs or under the buttocks, and over the shoulders; it is also referred to as a "full-body" harness. A Class III harness provides greater upper body support, which is useful for vertical operations such as confined space entry and helicopter hoists.

A Class III harness can be one piece or a combination of a Class II harness and a chest harness that connect together. A Class II harness used with a separate chest harness provides upper body support but might not transfer the user's load to the Class II harness.

While both types of harnesses are capable of fall arrest, the most commonly used industrial fall protection attachment points are sternal or dorsal, which requires a full-body harness.

NFPA 1983 requires that both the Class II and Class III harnesses pass a head-down drop test to verify the harness will not allow the user to fall out of it. In some cases, the organization could require both types.

A.30.4.2 NFPA 1983 provides for two types of attachment points: load bearing and positioning. A load bearing attachment point is designed for a higher static load and for an impact load. A positioning attachment point is intended only to support the user's weight while the user is sitting in the harness or for travel restraint to prevent the user from reaching a location where a fall could occur.

Load bearing attachment points are usually at the front waist and the sternal and dorsal locations. The front waist attachment point is the most common on life safety harnesses and provides the most useful attachment location for descents and for working in the harness. This attachment point allows the user to sit in the harness and allows maximum mobility for operations such as pick-offs and litter tending.

Because the sternal attachment point is above the user's center of gravity, it holds the user in a more upright position while transferring the load to the waist and leg straps of the harness. A sternal attachment point would be selected if a more upright position is required, such as for entry into a narrow space or helicopter hoist operations. The sternal point is also used for limited fall arrest, allowing the user to be stopped in a more upright position and facing the life safety rope.

The dorsal attachment point is used for fall arrest system attachment in an industrial-type work situation where space below the user is provided for the arrest.

Positioning attachment points are usually at the side, shoulder, or rear waist. Side attachment points would be selected if the wearer will be leaning back into the harness while attached to a structure. They provide a more stable position than a single attachment point at the front waist.

A Class 3 harness with shoulder attachment points would be selected when there is a requirement to lift the user in linear body position for movement through a narrow space.

The rear waist attachment point is used for travel restraint to prevent a fall when the user is working near an edge.

A.30.4.3 Comfort and ease of donning are both subjective evaluations of harness performance. Due to the human factors involved, practice with different harnesses or review of evaluations by other organizations will be required.

Weight is another function of comfort. A Class 3 harness with multiple attachment points weighs several pounds and while providing the user comfort during suspension, the added weight must be carried when the user is walking or climbing.

The purchaser should ensure that proper sizes are available to accommodate on-duty personnel.

A.30.4.4 Specialty fibers are used in construction of a harness to meet exposures not normally found in rescue situations.

Fire-resistant (FR) fibers provide a greater durability when exposed to the heat of fire ground operations and can be an essential specification for harnesses worn for escape. The FR fiber webbing is more expensive and has a shorter service life.

Hazmat or confined space operations can create an exposure to certain chemicals. If anticipated exposures are known, then webbing made from fiber resistant to that chemical can be specified.

For water and flood rescue operations, water reduces the performance of nylon; a hydrophobic fiber will dry quicker.

A.30.4.6 The personnel conducting the evaluations should wear the harness with the equipment to be used and with other required PPE. The evaluators should conduct simulated operations such as rappels, emergency escape descents, high angle stretcher tending, low angle stretcher tending, and work-at-height operations.

A.30.5 Belts do not provide the support of a harness, and their use must be limited to their specific functions.

A.30.5.2 An escape belt should be used only if the wearer will be suspended for the minimum amount of time necessary to reach a safe area. For most organizations, an escape belt is also used as a tool belt or an equipment belt.

A.30.5.3 A ladder belt has a positioning attachment point at the end of a tether. The maximum length of the tether is specified in NFPA 1983. The gate opening of the carabiner at the end of the attachment tether must be large enough to fit over the intended connection location on the organization's ladders.

An escape belt requires at least one load-bearing attachment point to which the escape system will be attached. This attach-

ment point selected must be compatible with the escape system.

A.30.5.4 Comfort and ease of donning are subjective evaluations of belt performance. Due to the human factors involved, practice with different belts or a review of evaluations by other organizations might be required. Evaluations should be done with the ensembles intended to be worn by the personnel, taking into consideration whether the belt will be worn over or under a coat, integrated with pants, and compatible with an SCBA or other PPE.

A.30.5.5 Specialty fibers are used in construction of a belt to meet exposures not normally found in rescue situations.

FR fibers provide a greater durability when exposed to the heat of fire ground operations and can be an essential specification for a belt worn for escape. The FR fiber webbing is more expensive and has a shorter service life.

Hazmat or confined space operations may create an exposure to certain chemicals. If anticipated exposures are known, then webbing made from fiber resistant to that chemical can be specified.

A.30.5.6 Accessories include but are not limited to loops, holsters, or pockets for carrying tools. Any accessory added to the belt should not interfere with the performance of the belt's intended function.

A.30.5.7 The personnel conducting the evaluations should wear the belt with any equipment that might be carried, with the ensemble to be worn, and with other required PPE. The evaluators should conduct simulated activities such as emergency escape descents or climbing and descending ladders.

A.30.6 A carabiner is an auxiliary system equipment item used to join other components to life safety rope or other system components. It is a load-bearing connector with a self-closing gate *(see Figure A.30.6)*.

A.30.6.1 For evaluating whether the organization should select general-use or technical-use carabiner, see A.30.1.2.1(6).

A.30.6.2 Carabiner gates have several different methods of preventing the carabiner from accidently opening during use.

The simplest design does not have a locking system and is usually referred to as a nonlocking carabiner. While having a long history of use for life support in the recreational field, nonlocking carabiners are not considered adequate for industrial or fire service use. See 6.5.5 of NFPA 1983.

Manual lock designs require a physical movement to activate the locking mechanism, which can be either a sleeve that screws the gate over the nose or a sleeve that, once activated, snaps into place. A physical movement is required to move the sleeve down to unlock the carabiner. Common names for this type of carabiner lock design include screw gate and manual lock.

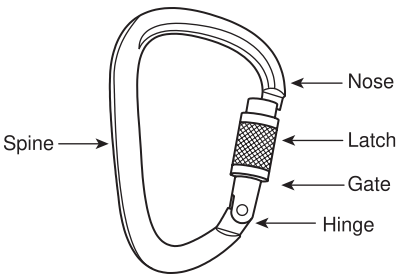

FIGURE A.30.6 Parts of a Carabiner.

An automatic locking gate is designed so that when the gate closes, a spring moves the sleeve up the gate and over the nose. Two or three physical movements are required to unlock the gate. This type of carabiner is usually referred to as auto-locking.

Auto-locking carabiners might be preferred for life safety use because the user does not have to remember to activate the gate-locking mechanism. Manual-lock carabiners have the advantage of easier removal from their storage location because they do not need to be unlocked first. Before relying on the carabiner for life support, the user must verify for both types that they are locked; while the gate might close automatically on the auto-locking model, if webbing or clothing blocks the gate from closing, the carabiner will be unlocked and could even remain open.

Some jurisdictions and activities require the use of ANSI-rated connectors, which have additional design, strength, and rating requirements. The AHJ needs to determine if all applicable regulatory requirements have been addressed while conducting a safety analysis for both incident and training environments.

A.30.6.3 The most common carabiner materials are steel and aluminum. Steel carabiners generally are the strongest and heaviest, but they weigh more than comparable-sized aluminum carabiners. Carabiners of aluminum and steel meet the general-use performance requirements of NFPA 1983. Consider which criteria must be met: strongest without consideration of weight or lightest while maintaining an acceptable safety margin.

In general, steel carabiners are plated or coated to resist rust and other corrosive effects. The quality of the finish and the expected atmosphere should be considered. Aluminum and stainless steel carabiners are affected less by rust but can be corroded by chemicals and atmospheres. Special or unique operations might require a specific material or additional care.

A.30.6.4 The shape and size of the carabiner are determined by the anticipated strength requirements and the size of components to which the carabiners will be attached. For example, a carabiner connecting to a ladder will need a wide gate opening and might utilize a pear shape to minimize weight. A carabiner connecting to a descent control device needs only to be large enough to fit through the device and the attachment point on a harness.

A carabiner with an asymmetrical shape shifts the load toward the spine and away from the gate, resulting in a carabiner that is stronger for its weight and size. As the load moves away from the spine, such as with triaxial loading, the effective strength of the carabiner is reduced. Common asymmetrical shapes are "D" and a modified "D."

A symmetrical carabiner centers the load equally on the gate side and the spine and is less susceptible to strength loss due to triaxial loading. For the same size and weight, the symmetrical carabiner is generally not as strong as an asymmetrical carabiner. Common shapes are oval and pear shaped.

Larger carabiners tend to be stronger due to the larger diameter stock used. They also fit over larger diameter connection points. Some models use an offset or side-swing gate to increase the gate opening for fit over large connection points. Small carabiners also can be very strong and have an advantage in being lighter, allowing more equipment to be carried.

A.30.7 A rope grab is an auxiliary system equipment item used to grasp a life safety rope for the purpose of supporting loads. Rope grabs include ascending devices.

An ascender is a type of rope grab auxiliary equipment that is a friction or mechanical device used to ascent a fixed line. Ascenders typically have a handle or other method of grabbing to allow them to be easily pushed up a rope.

A.30.7.1 For evaluating whether the organization should select general-use or technical-use equipment, see A.30.1.2.1(6).

A.30.7.2 Rope grabs have several different methods of gripping the rope.

Pressure Plates. Typical fall protection rope garbs used in industrial fall arrest have wide plates that spread the force applied to the rope grab's attachment point to a large area of the rope compared to other rope grabs. This type of rope grab is often designed to slip on the rope at a force low enough to prevent injury to the user in a fall.

Enclosed Cams. Many technical rope rescue rope grabs have a cam that is also the direct attachment for the load on the rope grab in use. Typically, the cam is removable by a pin that acts as the fulcrum of the cam. The cam applies force by compressing the rope between the cam and the body of the rope grab. These types of rope grabs are often designed not to slip or to slip at a force high enough to allow them to be used in typical mechanical advantage rope systems. They should not be used for fall arrest.

Rope grabs used in hauling systems tend to be the heavier aluminum models that completely close around the rope. These types usually require two hands to place them on or remove them from the rope but are typically mechanically stronger frames because of the enclosed design. Even so, the true strength of a rope grab can be determined only in conjunction with the rope chosen to be used with it, since the action of the rope grab can cause failure in the rope. Some rope grabs are designed to slip at a high load to protect the rope from being cut; others will continue to dig in until the rope fails.

Handled ascenders. Rope grabs used as ascenders for personal ascending of a fixed line typically are made to be easily placed on or removed from the rope with one hand. They tend to have a single open side with a safety that prevents the ascender from coming off the rope inadvertently. The cam is often a fixed pivot point with a curved frame to guide the rope and a safety device to prevent accidental removal from the rope. These types of rope grabs (ascenders) typically are not rated as strong as other types and are usually used in pairs for ascending ropes. They should not be used for fall arrest or mechanical advantage rescue systems due to their typically lower strength rating.

A.30.7.3 The most common rope grabs are steel and aluminum. Steel rope grabs generally are the strongest and heaviest, but they weigh more than a comparable-sized aluminum grab. Steel and stainless steel rope grabs typically are found as personal fall protection grabs for industrial use as worker protection. They can be used as self-trailing rope grabs on a second life line when ascending or descending a main life line or as a backup for ladder climbs. Industrial fall protection rope grabs carry an ANSI/ASSP Z359, *Fall Protection Code*, or similar certification.

In general, steel rope grabs are plated or coated to resist rust and other corrosive effects. The quality of the finish and the expected atmosphere should be considered. Aluminum and stainless steel rope grabs are affected less by rust but can be corroded by chemicals or atmospheres. Special operations might require a specific material or additional care.

A.30.7.4 Of all the equipment used in technical rope rescue, a rope grab's performance is affected the most by the rope used with the rope grab. Subtle differences in rope materials, sizes, and construction can give dramatically different strength or slippage results with rope grabs. Rope grabs of aluminum and steel might meet the general-use performance requirements of NFPA 1983, but the user must ensure that the desired strength has been tested on the specific rope that will be used with the rope grab. For that reason, most rope grabs on the market meet only the technical-use performance requirements of NFPA 1983. Consider which criteria must be met: strongest without consideration of weight and slippage or lightest while maintaining an acceptable safety margin.

A.30.8.1 The MBS of approved throwlines is specified in NFPA 1983, but consideration must be given to the possibility of a multi-person load when a throwline is used in actual rescue scenarios. Throwlines are designed primarily for the safe capture of single waterborne individuals from a land-based or boat-based platform.

A.30.8.2 The acceptable diameter range of approved throwlines is specified in NFPA 1983. End users must consider both volume (desired length) and grip (diameter and weave) characteristics of throwlines. Larger diameter throwlines require larger containment bags and take up increased storage space, but they offer both increased strength and better grip functions when wet.

A.30.8.3 The ability of throwlines to float, which is required by NFPA 1983, greatly enhances retrieval of a victim from water. Nonfloating throwlines have the disadvantage of increased weight when they become saturated during victim retrieval from a water environment. When rope submerges, it can create a snag hazard, potentially causing a hazardous situation in moving water. For a throwline to float, it must have a specific gravity of less than 1, and the fibers meeting that requirement usually are not as strong as the fibers used in life safety rope. The organization might determine that any throwline selected meets its requirements for floatability.

A.30.8.4 The handling characteristics of a throwline are important because it needs to remain flexible, wet or dry, and be supple enough to be readily repacked in its original form for immediate reuse.

A.30.8.5 The maximum length that a strong person can deploy a throwline using a throwline bag is about 24 m (80 ft). Shorter lengths depend on the width of the water courses in the jurisdiction and how the throwline is transported by the user. Longer lines might be selected for deployment from bridges or by other means. Users operating in boats often

select a shorter length due to the greater limits on the distance the bag can be thrown.

A.30.8.6 A water rescue throwline should be stored in a bag that allows ease of transport and also allows the throwline to be deployed farther and with greater accuracy. The bag should have some flotation to help the end of the throwline stay on the surface and for greater visibility in the water. There also should be a means for connecting the throwline to the bag. The bag should be constructed in a manner that allows water to flow through it during deployment and provides air circulation. Other considerations include the ability to attach the bag to the rescuer for transport and attachment points or pockets for a carabiner or lightstick. High visibility materials improve the visibility of the bag when deployed.

A.30.9.1 The function of a descent control device is to control the lowering of a load suspended by a life-safety rope. The descent control device adds variable friction to the rope, allowing one person to control the rate of descent. The operator and the device could be stationary at the top or could be moving along the rope, as in a rappel. Some designs are limited to one type of descent, while others perform well for various applications. For example, a brake bar rack is a popular rappel device for cavers and a common device for the main line for lowering a litter system. The device used for both of those applications is too large and too heavy to be carried as an escape device and would not be the best fit for the smaller rope and webbing used for with the escape device.

A.30.9.2 Anticipated loads could be as high as 4 kN (900 lbf) for a litter system with a patient and two tenders. For a single-purpose escape descent device, the anticipated maximum load would be limited to 1.33 kN (300 lbf). For evaluating whether the organization should select general-use or technical-use equipment, see A.30.1.2.1(6).

A.30.9.3 Many different descent control devices are available to rescuers. It is important to note the vast design and operating differences in traditional variable friction devices to devices with auto-locking and/or panic-stop features. Selection should be based on an evaluation of the interaction of the descent control device with not only the life-safety rope selected but with the entire rescue system. For example, some descent control devices do not need to be removed from the system and can be used as a progress capture pulley during conversion from a lowering system to a mechanical advantage system. The experience of the rescuers and the organization's standard operating procedures also should be considered to ensure that a system is in place to stop a load from moving unintentionally (e.g., belay system, auto-locking descent control device). The following advantages and disadvantages should be compared when selecting a descent control device:

(1) Manual and auto-locking are the two primary functional types of descent control devices. An auto-locking device requires the operator to activate the device to allow the rope to slide through. If the operator lets go, the rope movement stops. A manual device requires the operator to maintain a grip on the rope during lowering and physically tying off the device when stopped. Most manufacturers of auto-locking devices recommend maintaining a hand grip on the rope as a safety back-up. Manual devices tend to be simpler, have fewer moving parts subject to wear, are easier to inspect, and might be lighter in weight than auto-locking devices. Many of the current auto-locking designs are intended for rappel and might not be robust enough for litter systems.

(2) A descent control device designed for escape or bailout should be small and lightweight for wear with turnouts but still be easy for the rescuer to operate when wearing PPE gloves. A descent control device for a lowering system can be more robust, and weight might be less of a factor if it is used primarily when attached to a vehicle or over the side systems.

(3) Descent control devices are marked with the diameter of life safety rope for which they are designed to be used. Even with the compatible diameter, performance can vary both to the MBS and to their effectiveness. Descent control devices are tested in a manner of function, and the MBS can vary significantly, depending on the life safety rope used. The manufacturer can supply the specifications of the rope for which the descent control device has been tested. The amount of friction generated by the descent control device also varies, depending on the life safety rope used and should be evaluated with field trials.

(4) The material of manufacture is a consideration for durability. For surfaces contacting the life safety rope, generally steel or titanium wears longer than aluminum, an important consideration for heavily used descent control devices. The added weight or expense might not be warranted for a seldom used descent control device, such as an escape device.

(5) The ability of the descent control device to dissipate heat is important for long lowers. The simpler, manual devices such as brake bar racks and brake tubes seem to dissipate heat well. Some auto-locking devices have a manufacturer-specified maximum descent distance due to heat build-up.

A.30.9.4 The level of initial training and the frequency of ongoing training are factors in determining which descent control device is best suited for the organization. For example, a technical team that works with a variety of rope rescue equipment and trains regularly will maintain a competency that allows a wider choice of descent control device and might have different types available.

(1) Pre-rigged descent control devices are the preferred choice for escape and bailout primarily because of the requirement for immediate deployment. A pre-rigged descent control device also could be used for basic rope systems in which the response analysis shows a consistent type of rescue. For example, a truck company that responds to over-bank rescues could have the life-safety rope rigged to the descent control device and ready to attach to the anchor and the rescuer when the rope is pulled out of the rope bag.

(2) Auto-locking devices use a lever to vary the friction. Pushing or pulling the lever reduces friction and allows the rope to move through the device faster. Pushing or pulling more increases the rate. If the operator panics and holds the descent control device open, the load will not be stopped. Some of the auto-locking descent control devices have a panic-stop function in which a full push (or pull) slows or stops the movement. While this safety feature can be valuable, the trade-off is that the descent control device's "sweet spot," where the rope runs through best, can be hard to find in some designs.

(3) The organization should evaluate the compatibility of its operational procedures with rigging the rope into the device; manipulating the device to adjust the friction,