IEEE STANDARDS ASSOCIATION

IEEE Standard for Fall Protection for Electric Utility Transmission and Distribution on Poles and Structures

IEEE Power and Energy Society

Sponsored by the
Transmission and Distribution Committee

IEEE
3 Park Avenue
New York, NY 10016-5997
USA

IEEE Std 1307™-2018
(Revision of IEEE Std 1307-2004)

IEEE Std 1307™-2018
(Revision of IEEE Std 1307-2004)

IEEE Standard for Fall Protection for Electric Utility Transmission and Distribution on Poles and Structures

Sponsor

Transmission and Distribution Committee
of the
IEEE Power and Energy Society

Approved 23 October 2018

IEEE-SA Standards Board

Abstract: General recommendations for fall protection and rescue are provided. Sufficient details of the methods, equipment, and training requirements necessary to provide minimal risk procedures for personnel working at elevated worksites are presented.

Keywords: carabiner, climber certification engineered system, fall arrester, fall arrest system, fall prevention system, fall protection program, fall protection system (hardware), IEEE 1307™, total fall distance, work positioning system

The Institute of Electrical and Electronics Engineers, Inc. 3 Park Avenue, New York, NY 10016-5997, USA

PDF: ISBN 978-1-5044-5289-2 STD23398
Print: ISBN 978-1-5044-5290-8 STDPD23398

Important Notices and Disclaimers Concerning IEEE Standards Documents

IEEE documents are made available for use subject to important notices and legal disclaimers. These notices and disclaimers, or a reference to this page, appear in all standards and may be found under the heading "Important Notices and Disclaimers Concerning IEEE Standards Documents." They can also be obtained on request from IEEE or viewed at http://standards.ieee.org/IPR/disclaimers.html.

Notice and Disclaimer of Liability Concerning the Use of IEEE Standards Documents

IEEE Standards documents (standards, recommended practices, and guides), both full-use and trial-use, are developed within IEEE Societies and the Standards Coordinating Committees of the IEEE Standards Association ("IEEE-SA") Standards Board. IEEE ("the Institute") develops its standards through a consensus development process, approved by the American National Standards Institute ("ANSI"), which brings together volunteers representing varied viewpoints and interests to achieve the final product. IEEE Standards are documents developed through scientific, academic, and industry-based technical working groups. Volunteers in IEEE working groups are not necessarily members of the Institute and participate without compensation from IEEE. While IEEE administers the process and establishes rules to promote fairness in the consensus development process, IEEE does not independently evaluate, test, or verify the accuracy of any of the information or the soundness of any judgments contained in its standards.

IEEE Standards do not guarantee or ensure safety, security, health, or environmental protection, or ensure against interference with or from other devices or networks. Implementers and users of IEEE Standards documents are responsible for determining and complying with all appropriate safety, security, environmental, health, and interference protection practices and all applicable laws and regulations.

IEEE does not warrant or represent the accuracy or content of the material contained in its standards, and expressly disclaims all warranties (express, implied and statutory) not included in this or any other document relating to the standard, including, but not limited to, the warranties of: merchantability; fitness for a particular purpose; non-infringement; and quality, accuracy, effectiveness, currency, or completeness of material. In addition, IEEE disclaims any and all conditions relating to: results; and workmanlike effort. IEEE standards documents are supplied "AS IS" and "WITH ALL FAULTS."

Use of an IEEE standard is wholly voluntary. The existence of an IEEE standard does not imply that there are no other ways to produce, test, measure, purchase, market, or provide other goods and services related to the scope of the IEEE standard. Furthermore, the viewpoint expressed at the time a standard is approved and issued is subject to change brought about through developments in the state of the art and comments received from users of the standard.

In publishing and making its standards available, IEEE is not suggesting or rendering professional or other services for, or on behalf of, any person or entity nor is IEEE undertaking to perform any duty owed by any other person or entity to another. Any person utilizing any IEEE Standards document, should rely upon his or her own independent judgment in the exercise of reasonable care in any given circumstances or, as appropriate, seek the advice of a competent professional in determining the appropriateness of a given IEEE standard.

IN NO EVENT SHALL IEEE BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO: PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE PUBLICATION, USE OF, OR RELIANCE UPON ANY STANDARD, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE AND REGARDLESS OF WHETHER SUCH DAMAGE WAS FORESEEABLE.

Translations

The IEEE consensus development process involves the review of documents in English only. In the event that an IEEE standard is translated, only the English version published by IEEE should be considered the approved IEEE standard.

Official statements

A statement, written or oral, that is not processed in accordance with the IEEE-SA Standards Board Operations Manual shall not be considered or inferred to be the official position of IEEE or any of its committees and shall not be considered to be, or be relied upon as, a formal position of IEEE. At lectures, symposia, seminars, or educational courses, an individual presenting information on IEEE standards shall make it clear that his or her views should be considered the personal views of that individual rather than the formal position of IEEE.

Comments on standards

Comments for revision of IEEE Standards documents are welcome from any interested party, regardless of membership affiliation with IEEE. However, IEEE does not provide consulting information or advice pertaining to IEEE Standards documents. Suggestions for changes in documents should be in the form of a proposed change of text, together with appropriate supporting comments. Since IEEE standards represent a consensus of concerned interests, it is important that any responses to comments and questions also receive the concurrence of a balance of interests. For this reason, IEEE and the members of its societies and Standards Coordinating Committees are not able to provide an instant response to comments or questions except in those cases where the matter has previously been addressed. For the same reason, IEEE does not respond to interpretation requests. Any person who would like to participate in revisions to an IEEE standard is welcome to join the relevant IEEE working group.

Comments on standards should be submitted to the following address:

Secretary, IEEE-SA Standards Board
445 Hoes Lane
Piscataway, NJ 08854 USA

Laws and regulations

Users of IEEE Standards documents should consult all applicable laws and regulations. Compliance with the provisions of any IEEE Standards document does not imply compliance to any applicable regulatory requirements. Implementers of the standard are responsible for observing or referring to the applicable regulatory requirements. IEEE does not, by the publication of its standards, intend to urge action that is not in compliance with applicable laws, and these documents may not be construed as doing so.

Copyrights

IEEE draft and approved standards are copyrighted by IEEE under US and international copyright laws. They are made available by IEEE and are adopted for a wide variety of both public and private uses. These include both use, by reference, in laws and regulations, and use in private self-regulation, standardization, and the promotion of engineering practices and methods. By making these documents available for use and adoption by public authorities and private users, IEEE does not waive any rights in copyright to the documents.

Photocopies

Subject to payment of the appropriate fee, IEEE will grant users a limited, non-exclusive license to photocopy portions of any individual standard for company or organizational internal use or individual, non-commercial use only. To arrange for payment of licensing fees, please contact Copyright Clearance Center, Customer Service, 222 Rosewood Drive, Danvers, MA 01923 USA; +1 978 750 8400. Permission to photocopy portions of any individual standard for educational classroom use can also be obtained through the Copyright Clearance Center.

Updating of IEEE Standards documents

Users of IEEE Standards documents should be aware that these documents may be superseded at any time by the issuance of new editions or may be amended from time to time through the issuance of amendments, corrigenda, or errata. An official IEEE document at any point in time consists of the current edition of the document together with any amendments, corrigenda, or errata then in effect.

Every IEEE standard is subjected to review at least every 10 years. When a document is more than 10 years old and has not undergone a revision process, it is reasonable to conclude that its contents, although still of some value, do not wholly reflect the present state of the art. Users are cautioned to check to determine that they have the latest edition of any IEEE standard.

In order to determine whether a given document is the current edition and whether it has been amended through the issuance of amendments, corrigenda, or errata, visit the IEEE Xplore at http://ieeexplore.ieee.org/ or contact IEEE at the address listed previously. For more information about the IEEE-SA or IEEE's standards development process, visit the IEEE-SA Website at http://standards.ieee.org.

Errata

Errata, if any, for all IEEE standards can be accessed on the IEEE-SA Website at the following URL: http://standards.ieee.org/findstds/errata/index.html. Users are encouraged to check this URL for errata periodically.

Patents

Attention is called to the possibility that implementation of this standard may require use of subject matter covered by patent rights. By publication of this standard, no position is taken by the IEEE with respect to the existence or validity of any patent rights in connection therewith. If a patent holder or patent applicant has filed a statement of assurance via an Accepted Letter of Assurance, then the statement is listed on the IEEE-SA Website at http://standards.ieee.org/about/sasb/patcom/patents.html. Letters of Assurance may indicate whether the Submitter is willing or unwilling to grant licenses under patent rights without compensation or under reasonable rates, with reasonable terms and conditions that are demonstrably free of any unfair discrimination to applicants desiring to obtain such licenses.

Essential Patent Claims may exist for which a Letter of Assurance has not been received. The IEEE is not responsible for identifying Essential Patent Claims for which a license may be required, for conducting inquiries into the legal validity or scope of Patents Claims, or determining whether any licensing terms or conditions provided in connection with submission of a Letter of Assurance, if any, or in any licensing agreements are reasonable or non-discriminatory. Users of this standard are expressly advised that determination of the validity of any patent rights, and the risk of infringement of such rights, is entirely their own responsibility. Further information may be obtained from the IEEE Standards Association.

Participants

At the time this draft standard was completed, the IEEE/ESMOL Standards Working Group had the following membership:

Edward Hunt, *Chair*
Bill McGough, *Vice Chair*

John Anthony
Kris Buchholz
Thomas Buonincontri
James Christensen
Donald Dodds
Eric Engdahl
Brian Erga
George Gela
Mark Hanner
Ryan Hill
Alan Holloman
Nestor Kilroe
Tom Rasler
Larry Schweitzer
Larry Stafford
Chuck Stinnett
George Stinnett
Eriks Surmanis
Jim Tomaseki
Keith Wallace
Jeff Wild

The following members of the individual balloting committee voted on this standard. Balloters may have voted for approval, disapproval, or abstention.

Saleman Alibhay
John Anthony
W. J. (Bill) Bergman
Wallace Binder
Thomas Buonincontri
William Byrd
James Cain
Robert Christman
Donald Dodds
Gary Donner
Michael Dood
Michael Garrels
George Gela
Jalal Gohari
Edwin Goodwin
Randall Groves
Lee Herron
Werner Hoelzl
Magdi Ishac
Richard Jackson
Piotr Karocki
Kamran Khan
Yuri Khersonsky
Jim Kulchisky
Thomas La Rose
Danna Liebhaber
Otto Lynch
William McBride
Thomas McCarthy
Jerry Murphy
Dennis Neitzel
Michael Newman
Gary Nissen
Tim Olson
Carl Orde
Lorraine Padden
Bansi Patel
Branimir Petosic
Christopher Petrola
Thomas Rozek
Bartien Sayogo
Devki Sharma
Jeremy Smith
Jerry Smith
Ryan Stargel
John Toth
John Vergis
Jane Verner
David Wallis
Daniel Ward
Kenneth White

When the IEEE-SA Standards Board approved this standard on 23 October 2018, it had the following membership:

Jean-Philippe Faure, *Chair*
Gary Hoffman, *Vice Chair*
John D. Kulick, *Past Chair*
Konstantinos Karachalios, *Secretary*

Chuck Adams
Masayuki Ariyoshi
Ted Burse
Stephen Dukes
Doug Edwards
J. Travis Griffith
Michael Janezic
Thomas Koshy
Joseph L. Koepfinger*
Kevin Lu
Daleep Mohla
Damir Novosel
Ronald C. Petersen
Annette D. Reilly
Robby Robson
Dorothy Stanley
Adrian Stephens
Mehmet Ulema
Phil Wennblom
Howard Wolfman
Yu Yuan

*Member Emeritus

Introduction

This introduction is not part of IEEE Std 1307-2018™, IEEE Standard for Fall Protection for Electric Utility Transmission and Distribution on Poles and Structures.

This standard provides requirements for a fall protection program for transmission and distribution structures and equipment. The requirements covered under this standard are based on sound engineering principles, engineering safety considerations, and research into the tools, methods, practices, and training provided to and by electric power workers. It does not include work in vaults, manholes, or other confined spaces. Requirements regarding stairways and scaffolding of all types are not considered in this standard.

Contents

IEEE Standard for Fall Protection for Electric Utility Transmission and Distribution on Poles and Structures

1. Overview

1.1 Scope

This standard provides requirements for a fall protection program for transmission and distribution structures and equipment. The requirements covered under this standard are based on sound engineering principles, engineering safety considerations, and research into the tools, methods, practices, and training provided to and by electric power workers. It does not include work in vaults, manholes, or other confined spaces. Requirements regarding stairways and scaffolding of all types are not considered in this standard.

1.2 Purpose

The purpose of this standard is to provide guidance, work methods, and equipment specifications to protect employees covered under the standard from being injured by falls, and provide emphasis to encourage further development in equipment, work methods, and training related to fall protection programs used for electric utility transmission and distribution work.

This document is intended to enhance other national, state, and local regulations, and to add specific requirements applicable to the utility industry. These specific requirements are not intended to replace their respective regulations.

2. Normative references

The following referenced documents are indispensable for the application of this document (i.e., they must be understood and used, so each referenced document is cited in text and its relationship to this document is explained). For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments or corrigenda) applies.

29 CFR 1910.132 (Personal Protective Equipment).[1]

29 CFR 1926.503 (Training Requirements for Fall Protection).

[1]CFR publications are available from the US. Government Printing Office, 732 N. Capitol Street, NW, Washington, DC 20401, USA (http://www.gpo.gov/).

Accredited Standards Committee C2-2017, National Electrical Safety Code® (NESC®).[2]

ANSI/ASSE A10.32, Fall Protection Systems American National Standard for Construction and Demolition Operations.[3]

ANSI A14.1, Safety Requirements for Portable Wood Ladders.

ANSI A14.2, Safety Requirements for Portable Metal Ladders.

ANSI A14.3, Safety Requirements for Fixed Ladders.

ANSI Z359, Safety Requirements for Personal Fall Arrest Systems, Subsystems, and Components.

ASTM F711, Specification for Fiberglass-Reinforced Plastic (FRP) Rod and Tube Used in Live-Line Tools.[4]

ASTM F887, Standard Specifications for Personal Climbing Equipment-Pole and Tree Climbers.

ASTM F914, Standard Test Method for Acoustic Emission for Insulated Aerial Personnel Devices.

CSA Z259, Design of Active Fall Protection Systems.[5]

IEEE Std 516™, IEEE Guide for Maintenance Methods on Energized Power Lines.[6,7]

OSHA Safety and Health Bulletin SHIB 03-24-2004 (Suspension Trauma).

3. Definitions

For the purposes of this document, the following terms and definitions apply. The *IEEE Standards Dictionary Online* should be consulted for terms not defined in this clause.[8]

activation distance: The distance traveled by a fall arrester or the amount of line paid out by a self-retracting device from the point of onset of a fall to the activation point where the fall arrester begins to apply a braking or stopping force. This activation point is where the fall arrester engages the lifeline or, in the case of a self-retracting lanyard, where an internal brake engages. Activation distance is part of the free-fall distance experienced in a fall.

adjuster: A means to shorten or lengthen a strap, webbing, or rope.

administrative authority: The governmental authority exercising jurisdiction over application of this standard.

anchorage: A point of attachment to which the fall protection system is connected.

[2]National Electrical Safety Code and NESC are both registered trademarks and service marks of The Institute of Electrical and Electronics Engineers, Inc.
[3]ANSI publications are available from the Sales Department, American National Standards Institute, 25 West 43rd Street, 4th Floor, New York, NY 10036, USA (http://www.ansi.org/).
[4]ASTM publications are available from the American Society for Testing and Materials, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, USA (http://www.astm.org/).
[5]CSA publications are available from the Canadian Standards Association, 5060 Spectrum Way, Suite 100, Mississauga, Ontario, Canada, L4W 5N6 (http://www.csa.ca/).
[6]The IEEE standards or products referred to in this clause are trademarks of The Institute of Electrical and Electronics Engineers, Inc.
[7]IEEE publications are available from The Institute of Electrical and Electronics Engineers, 445 Hoes Lane, Piscataway, NJ 08854, USA (http://standards.ieee.org/).
[8]*IEEE Standards Dictionary Online* is available at: http://dictionary.ieee.org.

attached: A climber is connected to an anchorage when utilizing a fall protection system to prevent or arrest a fall.

belt, line worker's body: A belt that consists of a belt strap and D-rings and may include a cushion section or a tool saddle.

capacity: The combined weight for which the component is designed to be used. Combined weight includes the user's body weight and clothing, tools, and other objects borne or carried by the user.

carabiner: A connector component generally comprised of a trapezoidal or oval shaped body with a normally closed gate or similar arrangement that may be opened to permit the body to receive an object, and when released, automatically closes to retain the object.

carabiner, locking type: Has a self-locking gate that remains closed and locked until intentionally unlocked and opened for connection or disconnection.

NOTE—Other types of carabiners exist for other purposes, but are not recommended for use in fall protection systems.[9]

climber: A worker who has completed training and has become competent in climbing.

climber in training: A climber who is in training to become a competent person for climbing, which could be referred to as a competent climber.

climbing: The vertical movement (ascending and descending) and horizontal movement to access or depart the worksite.

competent: Having demonstrated through training, experience, and authority for the purpose of identifying and correcting hazardous or dangerous conditions in a fall protection system, or any component thereof under consideration, as well as its application and use with related equipment.

connecting hardware: A rigid component or element that is used to couple parts of the system together, such as snap hooks and carabiners.

deceleration distance: The additional vertical distance a falling climber travels, including lifeline elongation, harness stretch, and excluding free-fall distance, before stopping, from the point at which the energy-absorbing device begins to operate. It is measured as the distance between the location of a line worker's body belt, or full-body harness attachment point at the moment of activation (at the onset of fall arrest forces) of the energy absorbing device during a fall, and the location of that attachment point after the climber comes to a stop.

detachable ladder: A sectioned ladder designed specifically for the structure on which it is used and is not always left permanently installed on the structure after access is no longer required.

detachable step: An individual ladder rung or step bolt used to access structures that is typically removed from the structure after access is no longer required.

D-ring: A connector used integrally in a line worker's body belt or full-body harness as an attachment element, and in lanyards, energy absorbers, lifelines, and non-permanent boom attachments.

energy (shock) absorber: A component whose primary function is to dissipate energy and limit deceleration forces that the system imposes on the body during fall arrest. Such devices may employ various principles

[9]Notes in text, tables, and figures of a standard are given for information only and do not contain requirements needed to implement this standard.

such as deformation, friction, tearing of materials, or breaking of stitches to accomplish energy absorption. An energy absorber causes an increase in the deceleration distance.

engineered system: A fall protection system that is designed and operates to withstand the maximum expected impact load while maintaining a specified overload capacity factor (OCF).

equipment certification: An act or process resulting in documentation that attests to product performance.

fall arrest system: The assemblage of equipment such as a full-body harness in conjunction with a connecting means, with or without an energy-absorbing device, and an anchorage to limit the forces a climber experiences during a fall. A fall arrest system is designed to prevent a climber, in the process of a fall, from falling more than the designed fall limit.

fall arrester: A device such as a rope grab that travels on a lifeline and automatically engages the lifeline and lock to arrest an accidental fall of a climber.

fall-out: *Syn:* **flip-out**.

fall prevention system: A system, which may include a work positioning system, intended to prevent a climber from falling from an elevation. Such systems include work positioning devices, guardrails, barriers, and restraint systems. Fall prevention systems are used to prevent climbers from falling from an elevation.

fall protection program: A plan intended to guard climbers from injury due to falls from elevations.

fall protection system (hardware): Consists of either a fall prevention system or a fall arrest system.

flip-out: The action of a climber or test torso being unintentionally separated from the body support component during or after fall arrest. *Syn:* **fall-out**.

free-fall distance: **A)** While using fall arrest, the vertical displacement of a fall arrest attachment point on the line worker's full-body harness between onset of the fall and just before the system begins to apply force to arrest the fall. This distance excludes deceleration distance, lifeline, and lanyard elongation, but includes any energy absorbing device slide distance or self-retracting device extension before they operate and fall arrest forces occur. **B)** While using work positioning, the vertical displacement of the work positioning device attachment point on the line worker's body belt between the onset of the fall and just before the climber or work positioning equipment begins to retard the fall.

harness: A component with a design of straps that is fastened about the climber in a manner to contain the torso and distribute the fall arrest forces over at least the upper thighs, pelvis, chest, and shoulders with means for attaching it to other components or subsystems. *Syn:* **full-body harness**.

in-house rescuer: A competent rescuer, by means of an employer program, authorized to rescue another climber.

jobsite: The assembly point at the structure or equipment where the climbers, tools, and vehicles are assembled to perform climbing to the worksite.

lanyard: A flexible line of webbing, rope, wire rope, or strap that generally has connecting hardware at each end for connecting to a full-body harness that could have an energy-absorbing device and is attached to an anchorage.

NOTE—Wire rope is reserved for special use only. It is required in operations where the lanyard is subject to being cut, and is prohibited in the vicinity of energized facilities.

lifeline: A component consisting of a flexible line for connection to an anchorage or anchorage connector at one end to hang vertically (vertical lifeline), or for connection to anchorages or anchorage connectors at both ends to span horizontally (horizontal lifeline). It serves as a means for connecting other components of a fall arrest system to the anchorage. A lifeline serves to extend the range of the user through the slideable connection of a fall arrester in the case of a vertical lifeline, or a connector or other device in the case of a horizontal lifeline.

maximum arrest force: The peak force measured by the test instrumentation during arrest of the test weight in the dynamic test.

outsourced rescuer: A third-party entity who provides rescue services from elevated work locations (fire departments, high angle rescue teams, etc.).

overload capacity factor: The number by which a maximum load is multiplied to help ensure that the system does not fail when loaded beyond the design load.

permanent fall protection system: A fall protection system permanently secured to a structure (e.g., a fixed cable anchorage system.)

pin-on platform: A platform temporarily attached by a pin to a boom to support a climber at an elevated worksite. A pin-on platform is a device typically used to support a single climber in a standing position.

pole strap: *See:* **work positioning strap**.

portable platforms: A platform temporarily installed on a pole or tower. The platforms are available in various lengths and materials. They may be fixed or may pivot in the horizontal direction when properly installed. The platform may have an anchorage point for a work positioning strap.

qualified person: One who possesses a recognized degree or professional certificate, with extensive knowledge and experience in the subject field; is capable of design, analysis, evaluation, and specifications in the subject; integrates safety rules, regulations, standards, and engineering; and knows how to select the right equipment for the job.

rescuer: A competent climber annually trained in rescue procedures. The competent rescuer shall be able to identify hazards and understand equipment inspection, care, and use.

restraint: A system that limits the climber's movement to prevent fall hazard exposure.

roll-out: A movement process by which a snap hook or carabiner unintentionally disengages from another connector or object to which it is coupled.

rope grab: A device that travels on a lifeline and automatically frictionally engages the lifeline and locks so as to arrest the fall of a climber.

safety strap: *See:* **work positioning strap**.

self-retracting device (SRD): A device that contains a drum-wound line that automatically locks at the onset of a fall to arrest the user, but that pays out from and automatically retracts onto the drum during normal movement of the person to whom the line is attached. After onset of a fall, the device automatically locks the drum and arrests the fall. Self-retracting devices include self-retracting lanyards (SRLs), self-retracting lanyards with integral rescue capability (SRL-Rs), self-retracting lanyards with leading edge capability (SRL-LEs), and hybrid combinations of these.

skates: Devices used in the climbing of flanged I-beam-type structures.

snap hook: A connector comprised of a hook-shaped member with a normally closed keeper or similar arrangement that may be opened to permit the hook to receive an object and, when released, automatically closes to retain the object. Snap hooks are described as follows: *Locking type,* with a self-closing, self-locking keeper that remains closed and locked until unlocked and pressed open for connection or disconnection.

NOTE—Other types of snap hooks exist for other purposes, but are not recommended for use in fall protection systems.

step bolt: A forged steel bolt with a molded button end, commonly bolted to a structure member where the unthreaded shank is used for climbing; designed specifically for climbing utility structures.

NOTE—A step in a wood pole is a pole step, not a step bolt.

suspension trauma: Also referred to as "orthostatic intolerance," may be experienced by climbers using fall arrest systems after a fall where a climber remained suspended in a harness. The sustained immobility may lead to a state of unconsciousness. Depending on the length of time the suspended climber is unconscious/immobile and the level of venous pooling, the resulting orthostatic intolerance may lead to death.

total fall distance: The maximum vertical distance between the person's fall arrest attachment point at the onset of a fall and the position after the fall is arrested, including free-fall distance and maximum deceleration distance.

transferring: The act of moving from one distinct object to another (e.g., between an aerial device and a structure).

transitioning: The act of moving from one location to another on equipment or a structure.

wood pole fall restricting device: A device designed to limit a fall to 0.61 m (2 ft) or less on wood poles.

work positioning strap/rope: A strap or rope with snap hook(s) to connect to the D-rings of a line worker's body belt or full-body harness that helps to position the climber while using a positioning system at the worksite.

work positioning system: A system of equipment or hardware that, when used with a line worker's body belt or full-body harness, allows a climber to be supported on an elevated surface, such as a pole or tower, and to work with both hands free. Falls are limited to no more than 0.61 m (2 ft).

worksite: The location on the structure or equipment where, after the climber has completed climbing (horizontally and vertically), the climber is in position to perform the work or task.

4. Fall protection program

4.1 Development of policies

Policy should be consistent with OSHA requirements and other established industry standards. Define roles and responsibilities of program administrators, trainers, climbers, and rescuers. Develop written fall protection and rescue procedures for identified fall hazards. Program administrators should be provided with adequate resources to develop and maintain a fall protection program. Developed policies define the requirements for climbers and rescuers, and the documentation required to adequately track compliance. Employers should provide adequate supervision to help ensure program policies are followed. Policies shall address frequency and content of training.

4.2 Hierarchy of controls

Identify and eliminate the fall hazards by using administrative controls, determine the need of engineering controls, and specify the required fall protection and rescue equipment.

4.2.1 Administrative controls

A qualified person shall identify and rank fall hazards and determine the methods and procedures to reduce or eliminate fall hazards during installation and maintenance. This also includes the proper selection of personnel and equipment as required for each operation. (An example of personnel and equipment selection could be the use of competent climbers and bucket trucks.

4.2.2 Engineering controls

Fall protection shall be considered during the design of structures and equipment. Structures and equipment in service shall be evaluated for fall protection purposes. Possible design basis that either eliminate or reduce the chance of falls should be considered. A lifeline system shall be designed by a qualified person. (Examples of engineering controls could be the addition of platforms, guardrails, lifelines, anchorage points, transformer posts, and ladders.)

4.2.3 Fall protection and rescue equipment

Fall protection and rescue equipment include restraint, work positioning, fall arrest, and rescue systems. All equipment shall be certified and subject to regular routine inspection by a competent person. (Examples of fall protection and rescue equipment could be anchorage points, vertical lifeline, horizontal lifeline, and bucket trucks.)

4.3 Develop training program

Employers shall develop, maintain, and document a training program consistent with the fall protection program policies. Trainers shall have a working knowledge of applicable fall protection rules and regulations, standards, equipment, and engineering systems. Training should include hazard identification; proper use, care, and inspection of equipment; climbing; and rescue procedures. All training programs shall be documented.

5. Training

5.1 General requirements

Climbers shall be trained in the use of fall protection equipment and in the application limits, proper anchoring and tie-off techniques, rescue systems deceleration distances, inspection, and storage. Climbers required to use fall protection equipment shall become familiar with manufacturers' recommendations and maximum permitted free-fall distances.

In addition to fall protection training, it is essential that each climber be given sufficient training to understand safe electrical clearances (Minimum Approach Distance).

Climbing instruction shall be precise to help ensure the climber can recognize and avoid hazardous conditions.

Trainers shall have a working knowledge of applicable fall protection rules and regulations, standards, equipment, and systems.

The trainer shall explain and demonstrate the use of fall protection and rescue equipment used by the climber. The climber shall become proficient in the selection, inspection, and proper use and care of the equipment.

See 29 CFR 1926.503 for training requirements for fall protection.

5.2 Climber in training

A climber in training shall be attached at all times to an approved fall protection system at elevations in excess of 1.22 m (4 ft).

Training shall be based on the type of structure to be climbed (e.g., lattice, steel pole, concrete, wood). When the trainee successfully completes this training, the trainee may be considered competent by the employer. Training shall include instruction in the following areas:

a) Recognition of any hazards unique to the structure to be climbed.

b) Selection of the proper climbing equipment and fall protection system.

c) Proper care, inspection, and maintenance of climbing equipment and fall protection systems or devices.

d) Proper use of fall protection system.

e) Climbing methods, such as:

   1) Being attached at all times while climbing.

   2) Work positioning.

   3) Transitioning.

   4) Transferring and other climbing techniques.

f) Considerations associated with energized facilities.

g) Techniques for safely performing aerial rescue.

h) How orthostatic intolerance/suspension trauma may occur. (See OSHA Safety and Health Bulletin SHIB 03-24-2004.)

5.3 Rescue training

Climbers shall be trained and have demonstrated proficiency in the rescue procedures relevant to the work they perform. Rescue training shall be practiced by designated rescuers at least annually (competent climbers).

5.4 Documentation

The employer shall document that each employee has been trained and has demonstrated proficiency in fall protection principles required by this standard. The documentation shall be retained for the duration of the employee's employment. A copy of the documentation may be given to the employee.

5.5 Retraining

The employer is responsible for assuring that a climber possesses the skills and knowledge to perform the job safely. Employees who, in the judgment of responsible supervision, fail to demonstrate adequate skills, knowledge, or proficiency, or who have not performed climbing for one year, shall be retrained.

6. Rescue and/or escape

6.1 General

A rescue plan identifying what equipment and what procedure to be used shall be discussed prior to any climbing activities. A dedicated rescue system should be used for rescues.

Historically, rescues have been performed using working handlines. Potential hazards of using handlines for rescue include the use of snap hooks and sheaves not rated for human support. Handline rope may not meet rescue strength requirements. Potential degradation of handline rope due to UV exposure, daily use and wear, and dirt and oil contamination can contribute to reducing handline strength creating potential breaking hazards for rescue situations. If a handline is to be used, it shall be inspected and maintained prior to each use to help ensure integrity.

6.2 In-house rescuer

Rescue and escape procedures shall be established for prompt rescue of a climber. These procedures shall include self-rescue and assisted-rescue techniques, with consideration of suspension trauma.

Rescue equipment (such as providing anchor attachments, connectors, controlled descent device, means of communication, etc.) shall be provided and readily available prior to climbing activities or ascending in aerial lifts.

Climbers suffering trauma due to a fall goes beyond the scope of this standard. Generally, emergency personnel are required to evaluate the injured climber's condition and to provide immobilization equipment, stokes/basket-type litter, or other rescue equipment. When planning or executing rescue and escape measures involving energized facilities, the first consideration shall be to maintain Minimum Approach Distances or de-energize the facilities.

As part of a rescue program, it is recommended that a competent rescuer be present during any climbing activities. A climber working alone should carry a communication device while working aloft.

6.2.1 Outsourced rescuer

If an employer decides to use an outsourced rescuer (to include calling 911), rescue activities shall be coordinated prior to climbing. Coordination shall include identification of all hazards and rescue procedures to be utilized prior to any climbing.

The employer shall have written procedures approved by the employer and the rescue agency for the site-specific work location. The rescue agency shall advise the employer in writing of its availability and capability, any limitations on the types of rescue it can perform, and detailed instructions regarding how they are to be called. For more specific information regarding using an Outsourced Rescuer, refer to ANSI 359.2–2007.

6.2.2 Rescue equipment

All dedicated rescue equipment shall meet the ANSI Z359.4–2007 or the most current requirements. All connector hardware, lanyards, harnesses, ropes, webbing, wire rope, or any other rescue system component shall have a minimum breaking strength of 13.3 kN (3000 lb).

Dedicated rescue equipment shall be onsite and readily available prior to any work at heights being performed. This equipment shall be kept clean, dry, and used only for rescue. Rescue equipment should be inspected at least annually.

6.2.2.1 Rescue anchorages

Rescue system anchorages shall have a static strength of 13.3 kN (3000 lb) for non-certified anchorages or five times the applied static load for certified anchorages (ANSI Z359.2). When more than one rescue system is attached to the same anchorage, the strength shall be multiplied by the number of rescue systems attached.

6.2.2.2 Descent devices

The preferred method of rescue consists of using an engineered descent device to safely control the speed and starting/stopping action of the descent. Descent device systems shall be sized to help ensure safe descent for the height of the rescue.

Automatically controlled descent devices shall have a maximum descent speed of 2 m/s (6.6 fps). Due to ease of rigging and control of descent, these devices are the safest, simplest, and quickest for both self and assisted rescue situations.

Manually controlled descent devices shall stop descent if operator control is released (hands off), or if excessive application of the control device is applied (panic grasp).

Friction devices require a level of training above other descent devices due to complex configurations and are not encouraged for rescue. Complex issues include proper rigging according to weight of victim, rope compatibility, lack of locking/stopping capabilities, and descent speed control (e.g., fisk descenders, figure eights, ladders).

7. Technical requirements for all fall protection system

7.1 Introduction

The following is technical and general information to support a fall protection program.

7.2 Anchorage design strengths

7.2.1 Fall arrest anchorages

Anchorages to which there is fall arrest equipment attached shall be capable of supporting at least 22.2 kN (5000 lb) per person, or shall be designed and documented by a qualified person (engineered system), installed, and used as part of a complete fall protection system that is rated with a minimum of two times the maximum arresting force. Energy-absorbing force ratings to be used in the calculations of engineered systems shall be obtained from the device manufacturer. Verify the impact forces on the climber's body do not exceed 8 kN (1800 lb). Anchorages shall be independent of any anchorage being used to support or suspend platforms.

Demonstration has shown that energy-absorbing devices can reduce the impact force to below 4 kN (900 lb). Energy absorbing lanyards are designed to slow the fall and absorb much of the energy (by tearing material or stitching) when impacted by a force.

7.2.2 Work positioning anchorage

Anchorages to which there is work positioning equipment attached shall be capable of supporting at least 13.34 kN (3000 lb) per person, or shall be designed and documented by a qualified person (engineered system) that maintains an overload capacity factor (OCF) of at least two. Adequate fall arrest anchorages are not always available; therefore, a work positioning system is used in such cases to hold a climber in position so a fall does not occur.

7.2.3 Restraint anchorages

Anchorages to which there is fall restraint equipment attached shall be capable of supporting at least 3.3 kN (742 lb) or twice the OCF per person.

7.2.4 Structures

The employer shall verify, by test or design, that the potential fall arrest or work positioning anchorages on structures meet the minimum strength requirements.

When it is infeasible to use an anchorage independent of the work surface (e.g., bare hand procedure off an insulated platform), an anchorage to the work surface may be considered. The anchorage (e.g., hook ladders, insulated platforms) shall meet the same strength requirements as the structure anchorage.

Horizontal lifeline systems should be designed by a qualified person.

7.2.5 Aerial devices

Employers shall verify that employees tie off at all times when working from an aerial device. Employers shall verify that employees use personal fall arrest systems while working on aerial devices and be rigged such that an employee can neither free fall more than 1.8 m (6 ft), nor contact any lower level.

An employer may comply with OSHA's fall protection requirements for aerial lifts in one of two ways:

a) Use of a body harness with a tether (fall restraint system), or

b) Use of a body harness with a lanyard and/or SRL (fall arrest system).

Booms that have been subjected to fall arrest impact loads shall be inspected prior to further use.

For additional information, please refer to the following standards: ANSI A92.2, ANSI A92.3, ANSI A92.5, ANSI A92.6, and ASTM F914 for Standard Test Method for Acoustic Emission for Insulated Aerial Personnel Devices.

7.2.6 Cable-supported devices

The use of cable-supported devices frequently involves situations that preclude the availability of a fall protection anchorage from a near or adjacent structure. In these situations, the conductor supporting the device is the only anchorage available. It is the employer's responsibility to verify that the engineered strengths of these conductors adequately support the additional loads presented by the climber, conductor-supported device, tools, and equipment. A personal fall protection system should be directly attached to the conductor.

7.3 Fall protection and climbing equipment

Equipment shall, at a minimum, meet the requirements of ASTM F887 and ANSI Z359.

7.4 Fall forces and distances

7.4.1 Fall forces

The maximum arrest force on the body in a full-body harness shall be no more than 8.0 kN (1800 lb).

This standard recognizes that line worker's body belts are not to be used as part of a fall arrest system but can be used in addition with fall arrest equipment. In the event of a fall when climbers are using both work positioning

and fall arrest systems, it is reasonable to expect that their work positioning equipment can activate prior to their fall arrest equipment activation; therefore, this standard limits the forces on the line worker's body belt to 4.0 kN (900 lb).

7.4.2 Free-fall distance

A fall arrest system shall be rigged such that a climber cannot free-fall more than a maximum of 1.83 m (6 ft) (see Annex B). The component slack distance included in the free-fall distance is generally 152 mm (6 in).

Work positioning devices attached to an anchorage shall be rigged such that a climber cannot free-fall into the device more than 0.61 m (2 ft).

7.4.3 Deceleration distance

The deceleration distance shall not exceed 1.22 m (48 in). (See Annex B.)

7.4.4 Total fall distance

The total fall distance shall limit forces on the body to 8.0 kN (1800 lb) and not allow the climber to hit or land on any obstruction below the work location. "Lower level" does not include structure bracing members, or supporting vertical structures or conductors.

NOTE—See Annex B. There is no upper limit for the anchorage height as long as the distances in 7.4.2 and 7.4.3 are not exceeded. The anchorage for a fall arrest system is ideally above the climber's head and positioned to minimize hazards.

Consideration for pendulum-like swing falls and corresponding collisions, as well as the ability to affect rapid self-recovery can impact the decision on the anchorage attachment height. The location of available anchorages, in combination with the fall arrest system, may cause swing falls to occur.

8. Fall protection equipment types, inspection, and use

For fall protection equipment types, inspections, use, and precautions, the user shall read and understand the specific equipment manufacturer recommendations. Fall protection equipment standards include: ANSI Z359, ASTM F887, 29 CFR 1910. 132, 29 CRF 1915.159, and CSA Z259.

The following subclauses describe some examples of commonly used fall protection equipment.

8.1 Equipment types

8.1.1 Line worker's body belt

The line worker's body belt with a work positioning strap or lanyard is a fall prevention system if there is assurance that the work positioning strap or lanyard properly interacts with the structure anchorage, preventing a climber from falling from an elevation.

A line worker's body belt shall meet the requirements of ASTM F887 (latest version).

8.1.2 Full-body harness

Full-body harnesses shall meet the testing and manufacturing requirements of ANSI Z359.11 and ASTM F887–2013. Special consideration should be given when selecting a full-body harness for work in energized environments.

Full-body harnesses may be manufactured with or without integrated body belts.

8.1.3 Work positioning strap

Work positioning straps are used as a work positioning device in conjunction with a body belt or full-body harness. Commonly, work positioning strap components include fixed-end snap hooks, adjustable-end snap hooks, adjusting buckle, metal attachment clip, rivet, and 45 mm (1.75 in) or wider six-ply nylon load-carrying fabric. Work positioning straps can also be constructed using rope, rope grabs, carabiner connectors, adjustable nylon straps, etc.

The work positioning strap connectors shall not be in the same D-ring when around an anchorage or pole while in work or rest position.

Work positioning straps shall meet the requirements of ASTM F887. Lanyards manufactured in accordance with that standard may be used as a work positioning strap.

Wood pole fall restricting devices are designed to grab the pole in the event the climber becomes disengaged while climbing (cutting out), limiting the fall to 0.61 m (2 ft) or less.

8.1.4 Lanyards

Lanyards, fixed or adjustable length, can be constructed of rope or nylon webbing with a snap hook attached to both ends, or may be woven into one D-ring with connecting hardware (snap hooks, carabiner, etc.) on the other end. Lanyards are designed to connect the body support to a fall arrestor, energy absorber, anchorage connector, or anchor.

Lanyards shall meet the requirements of ANSI Z359.

8.1.4.1 Web lanyards

Knots shall not be allowed in web lanyards for any purpose. Connecting hardware shall not be connected to loops made in webbing-type lanyards unless specifically designed for the purpose.

Tie back or choker style connections shall not be made with web lanyards unless specifically designed to do so per manufacturer.

8.1.4.2 Rope lanyards

Rope lanyards are lanyards consisting of rope (fixed or adjustable), which typically have a connector at each end for connecting to the body support and to a fall arrestor, energy absorber, anchorage connector, or anchorage.

8.1.4.3 Energy-absorbing lanyard

Energy-absorbing lanyards are devices designed to control the amount of shock load to the body by decelerating the climber's fall. Energy absorbers may be tear-out stitching on webbing or other shock-absorbing material that controls the amount of energy transmitted to the climber in the event of a fall.

Energy absorbers shall meet the testing and manufacturing requirements of ANSI Z359.

8.1.4.4 Self-retracting lanyard

Self-retracting lanyards are attached to an automatic rewinding reel that quickly arrests a fall and limits the shock load to the climber.

Self-retracting lanyards shall meet the testing and manufacturing requirements of ANSI Z359.

8.1.5 Pole and tree climbers

Pole and tree climber components include the leg irons, gaff, ankle and leg straps, and leg pads. Climber leg irons are made of steel or aluminum alloy. Climbers may be adjustable or non-adjustable and may have replaceable or non-replaceable gaffs.

Pole and tree climbers shall meet the requirements of ASTM F887.

8.1.6 Skates

Straps shall be fastened prior to ascending or descending a structure.

Exercise caution when ascending and descending with skates to prevent slipping due to the presence of moisture, wetness, ice, oil, or scale rust on flanges.

The climbers shall keep their knees away from the structure, with their weight on their heels. The skate is released by lifting the heel and pointing the toes downward, releasing the grab of the rubber stoppers.

One foot is slid up while leaning back on the alternate foot. Descending is accomplished by alternately releasing and putting weight on each skate. Leaning forward on skates can cause them to lose contact with the structure and slip.

8.1.7 Anchorages

Anchorages are attachment points for fall protection systems able to withstand the shock load of a falling climber. Anchorages shall not allow movement of the anchoring device or lanyard in any direction if a fall should occur. Anchorages may be eyebolts, rigging points, slings, ropes, other attachments to the structure, or a lanyard wrapped around structural members to limit any movement of the lanyard at the connection point.

Anchorages shall meet the technical requirements of Clause 7.

8.1.8 Lifelines

Lifelines shall be protected against being cut or abraded. Not more than one climber shall be attached to any one lifeline unless the manufacturer’s design allows multiple climbers attachment.

Vertical and horizontal lifelines shall meet the requirements of ANSI Z359.

8.1.9 Rope grab with lifeline

Rope grabs shall be designed to allow free movement along a lifeline, yet to lock on the lifeline if a fall occurs. Rope grabs shall be compatible with the lifeline being used.

The operation of rope grabs in dirty conditions or in inclement weather shall be considered prior to use in those environments.

Rope grabs systems shall meet ANSI Z.359 requirements.

8.1.10 Fixed climbing devices (rail, tube, or cable with slider)

Fixed rail, tube, or cable with slider systems shall permit the climber to climb without continually having to hold, push, or pull any part of the system, leaving both hands free for climbing. The connection between the slider and the attachment point on a body belt or harness shall not exceed 229 mm (9 in).

Fixed rail, tube, or cable with slider systems shall meet the testing and manufacturing requirements of ANSI Z359.

8.2 Inspection and maintenance of fall protection equipment

Manufacturer's recommendations shall be followed for inspection and maintenance on all fall protection equipment. The employee shall visually inspect fall protection equipment prior to use to determine that the equipment is in safe working condition. This equipment shall be inspected at least annually by a competent person. Defective equipment shall be removed from service immediately.

8.2.1 Equipment inspection

The following subclauses contain general examples of items to inspect prior to each use and, at a minimum, annually by a competent person. The following items should not be considered all-inclusive.

8.2.1.1 Line worker's body belt

Line worker's body belt shall be inspected for the following:

a) Hardware has no cracks, nicks, distortion, or corrosion, and operates properly.

b) Loose or worn rivets are not present.

c) Waist strap has no loose grommets.

d) Worn materials that could affect the safety of the user are not present.

e) Modifications have not been made to carry tools or material.

8.2.1.2 Harness

Harness shall be inspected for the following:

a) Legible markings on tags.

b) Elements affecting the equipment form, fit, or function.

c) Evidence of defects or damage to hardware elements including cracks, sharp edges, deformation, corrosion, chemical damage, excessive heating, alteration, and excessive wear.

d) Evidence of defects in or damage to straps or ropes including fraying, kinking, knotting, broken or pulled stitches, excessive elongation, chemical damage, excessive soiling, abrasion, alteration, excessive aging, and excessive wear.

e) Alteration, absence of parts, or evidence of defects in, damage to, or improper function of mechanical devices and connectors.

8.2.1.3 Work positioning strap/ropes

Work positioning strap/ropes shall be inspected for the following:

a) Wear indicates the strap/rope material is not exposed.

b) Cuts, burns, extra holes, or excessive fraying of strap material. Rivets are properly secured.

c) Cracks, burns, or corrosion is in the connecting hardware.

d) Proper operation of all mechanical components.

8.2.1.4 Lanyards

Lanyard shall be inspected for the following:

a) Cuts, burns, extra holes, or excessive fraying of strap material.

b) Cracks, burns, or corrosion is in the connecting hardware.

c) Legible markings on tags.

d) Proper operation of all mechanical components.

e) Evidence of defects or damage including fraying, kinking, knotting, broken or pulled stitches, excessive elongation, chemical damage, excessive soiling, abrasion, alteration, excessive aging, UV damage, and excessive wear.

8.2.1.5 Pole and tree climbers

Pole climbers shall not be used if the gaffs are less than 32 mm (1.25 in) in length as measured on the underside of the gaff. Tree climbers shall not be used if the gaffs are less than 51 mm (2 in) in length as measured on the underside of the gaff.

Pole and tree climbers shall be inspected for the following:

a) Fractured or cracked gaffs or leg irons.

b) Wear on stirrup and leg iron.

c) Loose or dull gaffs or deformation that would affect use.

d) Proper sharpening of gaffs.

e) Broken straps or buckles.

f) Fasteners are tightened appropriately and have not been modified.

8.2.1.6 Skates

The user shall visually inspect skates for the following:

a) Cracks, stress, and strap damage.

b) Good condition of rubber stops. Rubber stops shall be turned if needed, or replaced if turning does not furnish a good grabbing surface, or if they are loose in the saddle.

8.2.1.7 Connecting hardware

Connecting hardware shall be inspected for the following:

a) Visible damage, such as deformation and cracks.

b) Proper operation of the gate assembly and locking mechanism.

8.3 Equipment usage

All equipment shall be used according to manufacturer's recommendations. Verify all components are compatible prior to use.

Equipment damaged, or suspected of being damaged, shall be removed from service and the entire system shall be inspected by a competent person. If no evidence of a defect is found, the equipment may be returned to service.

9. Methods

9.1 Introduction

This clause describes examples of fall protection methods used on various structures and equipment. The design and type of structure or equipment determines the method of climbing and fall protection systems required for climbing, transitioning, transferring, resting, and working. The requirements of this clause shall apply to all types of work.

In order to use a fall protection system, the structures involved may require modification to accept commercially available systems. See Clause 10 to verify the use of proper electrical minimum approach distances. See Annex C for a generalized list of conditions that are associated with critical fall situations.

Where the structure is not equipped with a permanently installed fall protection system, other fall protection systems such as double belting, wood pole fall restricting device, or the use of a shepherd's hook, rope grab, and vertical or horizontal lifeline may be available. The use of such methods can increase climber fatigue due to continually connecting and disconnecting these devices during ascent and descent. In addition, it forces the climber to focus on matters other than the primary objective of climbing. The attachment requirements of this clause applies to all climbers at an elevation greater than 1.22 m (4 ft), unless otherwise specified.

If an engineered climbing device is installed and operable, it shall be used to climb and descend the structure.

All climbers shall be attached or otherwise protected at all times.

NOTE—A harness is essential for prompt rescue.

9.2 Climbing, transitioning, and transferring

A competent climber routinely demonstrates a proficiency in climbing and rescue techniques, and is knowledgeable of the associated hazards. Work performed at elevated locations requires not only vertical ascending and descending, but very often, horizontal movement as well. Accessing elevated worksites often requires the climber to make moves around, over, under, or between structure members in order to gain position to perform the work.

If other fall protection has not been provided, fall arrest equipment, work positioning equipment, or travel restricting equipment shall be used by employees working and resting at elevated locations more than 1.2 m (4 ft) above the ground on poles, towers, or similar structures.

Careful consideration shall be given to the method of fall protection selected for work on a horizontal cross arm so as not to expose the climber to other hazards such as electrical contact. On horizontal surface, a positioning device may be used in conjunction with other fall protection devices. Inspect structures prior to climbing. Where structures or equipment may be unsafe for climbing, they shall not be climbed until made safe by guying, or other adequate means.

See the National Electric Safety Code ® (NESC®) for additional information.

9.2.1 Climbing and transitioning

9.2.1.1 Wood structures

A competent climber equipped with a line worker's body belt and/or harness with a wood pole fall restricting device, as well as a secondary means of attachment, may climb wood distribution and transmission, poles. If the following conditions exist, additional safety precautions should be taken:

—Pole conditions such as shell rot, shakes (delamination), severe checks, slick surfaces, or hard to penetrate with gaffs.

—Environmental or weather conditions such as wind, ice, and snow.

—Structural design, such as no pole top, lowering of X-braces, etc.

—Obstructions that may exist on a pole, such as shielding, optical fiber boxes, traffic-control boxes, etc.

9.2.1.2 Guyed and self-supporting lattice structures

While climbing, working, and resting, the climber shall be attached at all times.

Prior to climbing, perform an assessment to determine which method and equipment applies to the structure to be climbed.

For structures supplied with permanent fall protection systems, such as cable systems, engineered step bolts, and step bolt clips, the permanent system should be considered first. The following describes permanent fall protection systems:

—Cable system: Use a compatible slider attached to a harness as required by the cable system manufacturer.

—Engineered step bolts: Use a shock-absorbing Y lanyard per manufacturer's instructions.

—Step bolt clips: Use a shock-absorbing Y lanyard per manufacturer's instructions.

NOTE 1—Other permanent fall protection systems may be used as they become available.

For structures without permanent fall protection systems, a temporary fall protection system shall be used. The following describe temporary fall protection systems:

a) Lead climber: One of the biggest challenges of climbing lattice structures utilizing temporary fall protection systems is getting the lead climber to the elevated work location, while remaining attached at all times. The lead climber may:
   1) Refer to 9.2.2.1 when using a manlift to transfer the lead climber to a structure.
   2) Install engineered step bolts or clips that remain as a permanent fall protection system.
   3) Lead climber shall utilize the installed step bolts or clips for attachment during ascending.
   4) Install temporary step bolts or clips that may or may not remain as a permanent system. Lead climber shall utilize the temporary installed step bolts or clips for attachment during ascending.
   5) A safety device used to provide a temporarily portable anchorage point of a fall protection system (such as a buck hook) used as per manufacturer's instructions.
   6) Y lanyard with pelican hooks engaging lattice members while ascending.
   7) Other systems and methods that become available as developed.

NOTE 2—Last man down utilizes temporary systems while descending. Once the lead climber has reached the elevated work location, he may attach a vertical lifeline to a rated anchorage, allowing the remaining climbers to climb using the vertical lifeline and a slider device. OSHA only allows one climber at a time to be attached to a vertical lifeline.

b) Horizontal movement on the structure can be achieved by:

   1) Y lanyard with pelican hooks engaging overhead steel members.

   2) Temporary horizontal lifeline installed as per manufacturer's instructions.

c) Work at the end of an arm

   1) Working at the end of a crossarm with no appropriate anchorages for fall arrest requires the climber to be attached using a lifeline with fall arrester or an SRD anchored to the tower body. A positioning strap should be used to prevent swing fall and maintain position. Consideration needs to be given to maintaining Minimum Approach Distance and controlling the swing fall.

d) Work at the top of the tower

   1) There are no overhead anchorages available at the top of a tower, making a fall arrest system infeasible; therefore, the highest possible anchorage should be used. In this situation, the following methods should be used:

   2) Positioning with a secondary lanyard, maintaining a fall of less than 0.61 m (2 ft).

e) Rope access

   1) Rope access techniques require extensive training, knowledge, and specialized equipment, and can be used to access arms, conductors, and areas on structures without appropriate anchorages.

9.2.1.3 Tubular steel, concrete, composite, and special purpose structure

While climbing, working, and resting, the climber shall be attached at all times.

—Detachable ladders/permanent ladders:

—If using detachable ladder, permanent ladders, or a combination of both type ladders for fall protection anchorage, an engineering study should be performed to determine if the anchorage is adequate for the fall protection system being used.

—For the following, refer to 9.2.1.2 for additional information:

—Step bolts/clips

—Y lanyards

—Lead climbing

—Permanent fall arrest systems

—Work at the end of an arm

—Work at the top of a structure

—Rope access

9.2.1.4 I-beam structures

The use of mechanical climbing aids, such as skates, does not amend the requirements of this clause.

9.2.1.5 Ladders

Ladder standards considered in the following subclauses include ANSI A14.1 through ANSI A14.3, and ANSI A14.5.

9.2.1.5.1 Fixed ladders

Fixed ladders, where provided, shall be used for ascending and descending. Fixed rail or cable safety devices shall be used where available and operable.

Ladders and ladder rungs shall not be used as a fall arrest anchorages, unless an engineering study is performed to determine if the anchorage is adequate for the fall protection system being used.

It is recommended when using ladders for work positioning, that the work positioning straps should be placed around one ladder side rail above a rung, limiting the fall to less than 0.61 m (2 ft).

Fixed ladders are most commonly used on tubular steel, and at times on portions of lattice towers. In some instances, a fixed (rail or cable) climbing attachment is mounted on the structure or ladder.

9.2.1.5.2 Hook ladders (direct access to worksite)

Hook ladders can be placed in a wide range of configurations to meet the needs of the worksite. Consideration shall be given to the ladder's rating, particularly in the horizontal position and when performing energized work.

Transferring to and from the ladder requires continuous attachment. While transitioning, climbing, or working on the ladder, fall protection shall be used. To provide for greater stability, the hook ladder can be tagged (tied off) at the bottom to either the structure or to some ground-level fixed object (a chocked vehicle without keys in the ignition is often the only means available). Hook ladders are often used on steel, concrete, and composite structures as well as wood poles.

9.2.1.5.3 Detachable ladders and steps

A competent climber, while in the process of installing or removing detachable ladders or steps on the structure, shall use an appropriate fall protection system.

Detachable ladders and steps should fit into the clips or on the studs in such a fashion that they are not easily knocked out when bumped by workers, material, or tools.

A competent climber shall be equipped with fall protection equipment, and should consider the use of a secondary means of attachment when climbing and changing work positions.

Activities such as working and resting on a structure require the competent climber to be attached to the structure.

9.2.1.5.4 Non-self-supporting ladders (extension and single)

When work is to be performed from these ladder types, care shall be taken to properly stabilize the ladder and the climber.

Ladders are primarily designed for access to work locations. Ladder selection shall include the proper size and type of ladder, the proper stabilization of the ladder, and the following basic safe work principles:

—Climbers are not required to be attached to the ladder.

—Special precaution, such as securing the ladder to the structure or equipment, is required if the climber is transferring from the ladder. The ladder shall extend at least 0.91 m (3 ft) above the point of contact.

—Fall prevention depends on the safe use of non-self-supporting ladders. The climber should face the ladder, not exceed the highest permitted standing level, keep the belt buckle between the rails, and not push or pull material.

—When work is performed from a ladder, the climber should maintain three points of contact with the ladder, unless the ladder is secured at the top and work positioning equipment is used.

—It is preferable to tie the ladder firmly to the object being accessed to prevent the ladder from sliding or moving in such a manner that may cause the climber to fall. The use of fall arrest equipment is not practical when working on non-self-supporting ladders, as anchorage points are not available or would require extra climbing to establish.

9.2.2 Transferring

9.2.2.1 Transferring to and from an aerial device

A competent climber may transfer to/from a multi-worker aerial device (i.e., a multiple worker single basket or platform) to/from a structure, conductor, aerial ladder, or cable cart, provided that it is not prohibited in writing by the manufacturer, and

a) The basket shall be self-leveling or fixed-pin, or have a locking mechanism to provide stability during transfer.

b) The transfer is made to or from the device through a door, or by a portable ladder or step solely designed for the purpose of assisting the climber over the rim of the basket or platform. Portable ladders or steps shall not extend beyond the rim of the basket or platform. Portable ladders or steps shall be removed from the basket or platform when transferring is no longer required.

c) Two or more climbers shall be available at the point of transfer. One climber shall remain in the basket or platform and be attached to the aerial device at all times.

d) When transferring to or from a basket or platform, a climber shall be attached at all times to the aerial device and to the structure or equipment while making the transfer, keeping the double attachment time to a minimum.

NOTE—A competent climber wearing skates should transfer only through a door designed for that purpose.

9.2.2.2 Single-worker bucket aerial device

Transferring to or from a single-worker bucket shall not be permitted.

9.2.2.3 Helicopter

A risk assessment should be performed prior to using helicopters for transfer. To maximize safety, it is imperative to use the correct helicopter type and a highly-qualified pilot to perform transferring procedures.

NOTE 1—While attached to the helicopter, the line worker is part of the helicopter crew and is covered by the jurisdiction of the aviation authority (FAA in the U.S.).

NOTE 2—While attached to the structure, the line worker is covered by the safety authority (OSHA in the U.S.).

The competent climber shall be attached to the helicopter at all times when traveling between the ground and the aerial transfer point or worksite. Bare-hand work methods require the competent climber to be in contact with or bonded to the conductor or energized part and insulated or isolated from conductors or objects at a different potential. Care shall be taken to help ensure the fall protection system does not compromise the climber's insulated or isolated work positions.

9.2.2.3.1 Helicopter with a platform to/from a structure or conductor

Due to the extremely high-risk nature of transferring from a helicopter's skid or platform to a structure or conductor, a risk assessment should be performed to determine that the need for this process is equal to the risks involved.

If it is determined this method has to be used, due diligence should be used in studying and applying regulations and standards to determine the dangers surrounding this procedure.

9.2.2.3.2 Suspended from a helicopter to/from a structure or conductor

A fall protection system consisting of a harness (or equivalent device) and the appropriate connecting devices is required when a competent climber, suspended from a helicopter, is transferring to or from a conductor/structure. When the climber is placed in a stable position on the conductor/structure, he/she shall attach his/her fall protection system to the conductor/structure, and the climber shall immediately disconnect the connecting device from the helicopter. The time the climber is attached to both the helicopter and conductor/structure shall be kept to a minimum.

9.3 Working at elevated locations

9.3.1 Tower erection and removal

Lattice tower erection typically involves the joining of ground-assembled structure sections of the tower supported by a crane or helicopter at various elevations. The sections are joined together using bolted splice plates. The crane or helicopter slowly lowers a section for attachment to a previously installed lower section in a manner that allows the suspended section to be bolted to the splice plates already installed on the lower section. Most side bracing are left unfastened on both sections at the attachment points to allow the sections to be joined together smoothly. Usually four climbers, one on each leg, are in place at the top of the lower section waiting to position the suspended section to the lower section and install the bolts. There is no place above the climber to install fall protection until after the suspended section is bolted in place and the side bracing cannot often be used because it is not yet firmly bolted in place.

This is an extremely dangerous time for the climbers whose only escape route from trouble is to climb down the legs they are working on. Requiring attachment prior to having the new section minimally secured to the splice plates exposes the climbers to injury should trouble develop prior to catching off the upper section. Most climbers use their work positioning strap around the tower leg of the lower section while awaiting the placement of the upper section, and often elect to leave it in place until the sections are bolted.

This standard recognizes the danger involved at this point of the installation and similar installations, and determines it is up to the individual climber to decide the safest procedure for him or her to follow. During tower removal, the competent climber shall be required to be attached until the last bolt is ready to be removed. This requirement applies to all components of a tower, including arms.

9.3.2 Aerial devices

When working from an aerial device, climbers shall be attached using a fall protection system prior to the bucket or platform being raised, and shall remain attached except as permitted in Clause 9. The fall protection system shall consist of the following:

a) An anchorage determined by the manufacturer.

b) Full body harness with a connection device consisting of a lanyard with an energy absorbing device, SRDs with connecting hardware, or a restraint lanyard and connecting hardware shall be used to connect the harness to the anchorage.

NOTE 1—It is not required for climbers using an aerial device to be competent climbers.

NOTE 2—Aerial device may be used as the principle means to reach a suitable climbing device, such as a fixed ladder.

9.3.3 Cable carts, boatswain's chairs, etc

Cable carts, boatswain's chairs, and similar devices shall only be used by competent climbers who have had training on the specific device to be used.

Fall protection is required when working from cable-suspended equipment and attachment shall be anchored to the cable and not the suspended platform.

Before a cable cart or boatswain's chair is supported from a conductor, a visual inspection shall be performed on the conductor to identify any apparent physical damage or deterioration that may reduce the strength of the component. This inspection shall include the integrity of the conductor attachments at each end of the span to be traversed.

9.3.4 Portable platforms

A portable platform may be temporarily installed on a pole or tower to provide the line worker a convenient place to stand, and to place the worker in the correct vertical and horizontal relationship to the area to be worked. The platforms may be fixed or may pivot in the horizontal direction when properly installed.

To provide provisions for fall prevention and line worker work positioning, the platforms may have an auxiliary tripod or railing located to provide attachment for a work positioning strap. Unless it is specifically designed to provide fall protection, the auxiliary tripod or railing shall be used for work positioning only, not to withstand a free fall. The line worker shall use the structure for anchorage.

10. Structure design

New construction of elevated structures shall incorporate into their design all the features required to safely construct, climb, and maintain them. All attached wire and equipment shall also be included in the design, in accordance with the preceding clauses. Particular attention should be given to providing adequate anchorages, climbing and working space, and live work minimum approach distances. It is imperative that new designs consider the use of fall protection systems. See ANSI/ASSE A10.32–2004 for Fall Protection Systems American National Standard for Construction and Demolition Operations.

Specific fall protection components to be considered include fixed ladders, detachable ladders, pole or tower step bolts, working platforms, guardrails on platforms, electrical equipment anchorages, structure members to aid transferring to or from step bolts, engineered anchorages, and lifeline systems.

The supporting structures design shall take into account all the loads generated from fall protection components and verify the integrity between the supporting structures and the fall protection components. Design loads from fall protection components and their associated dynamic loads include, but are not limited to, the following components:

—Climber's body weight.

—Weight and application of climber's tools.

—Construction loads for the work to be performed.

—Loads from the rescue.

These design principles apply to poles, towers, and other similar structures.

The climbing space, working space, and minimum electrical approach distances listed in the NESC (Rule 236, Rule 237, and Rule 441), whichever is greater, shall be applied.

Permanently installed equipment and fixtures associated with climbing shall be provided for access to the highest work location on the structure. The principal access path is generally continuous, except for lateral points where the design provides for a safe transition.

10.1 Principal access path on elevated structures

10.1.1 Step bolts

Step bolts should not be used as an anchorage unless designed for that purpose, or approved by qualified person. If additional anchorage clips are used in conjunction with the step bolts, they shall meet the anchorage requirements for the method of attachment (refer to Clause 9).

Step bolts shall:

a) Have a minimum diameter of 16 mm (5/8 in) and a minimum clear width of 115 mm (4.5 in). They shall be firmly connected to the supporting structure with spring lock washers or lock nuts, and have button heads to prevent climber's foot slipping off during climbing.

b) Be vertically spaced a maximum of 153 mm to 457 mm (6 in-18 in), evenly spaced.

c) Provide a minimum toe clearance of 178 mm (7 in). Where an obstruction cannot be avoided, the toe clearance may be reduced, but shall be at least 140 mm (5.5 in).

d) Be capable of supporting the intended workload [as defined for the application per the applicable ANSI standard(s)], but in no case shall the minimum design live load be less than a simple concentrated load of 271 kg (598.4 lb) applied 51 mm (2 in) from the inside face of the step bolt head.

e) Be maintained in a safe condition and, where feasible, be inspected before each use, using an appropriate inspection technique. Step bolts that are bent greater than 0.26 radians (15 degrees) below the horizontal shall be removed and replaced with bolts that meet the requirements of this subclause.

If tower bracing, splice plates, etc., are within the 457 mm (18 in) spacing, they may be used as stepping points, provided they meet the above a), c), and d) requirements. In addition, the surface should be flat and level so that a climber's foot does not slide or get wedged in.

NOTE—Step bolts on lattice structures are usually located on one leg of the structure. A portable access ladder or temporary step bolts are required to reach the first step since it is located a minimum of 2.45 m (8 ft) above the ground (NESC paragraph 217.A.2).

Step bolts could be used as load-carrying bolts at splice locations to avoid additional plates and climbing issues.

10.1.2 Fixed ladders

Fixed ladders on elevated structures shall meet the following requirements:

a) The spaces between steps or rungs permanently installed on poles or towers shall be uniform, except where working, standing, or access steps are required, and shall be not less than 254 mm (10 in) nor more than 356 mm (14 in) apart. Fixed ladder rungs and step rungs for poles and towers shall have a minimum diameter of 16 mm (5/8 in). Fixed ladder rungs shall have a minimum clear width of 406 mm (16 in).

b) The minimum distance between obstructions behind the rungs shall be not less than 178 mm (7 in). Rungs shall be corrugated, knurled, dimpled, coated with skid-resistance material, or otherwise treated to minimize slipping, and shall be shaped such that a climber's feet cannot slip off of the end of the rungs.

c) The maximum grab bar width shall be less than 76 mm (3 in).

d) Fixed ladders and their components (steps or rungs, grab bars, cage) on elevated structures shall be capable of supporting their maximum intended load. Each fixed ladder shall be designed for fall arrest load from one climber and for fall rescue load from one rescuer. Each rung shall be designed for a simple concentrated load of 271 kg (600 lb), minimum, applied at the middle of the rung. Fixed ladders and their connections design shall also take the supporting structure deflections into account.

e) For public protection, the fixed ladders are started 2.45–3.05 m (8–10 ft) above grade level, necessitating the use of temporary ladders for access.

For additional information, see OSHA 1910.27.

10.1.3 Hook ladders (direct access to worksite)

Access to the worksite may require the use of hook ladders. Provisions shall be incorporated into the structure to accommodate such ladders, or similar ladders, with various ladder support attachments.

Hook ladders provide a means of accessing facilities that are specifically installed with a predetermined clearance from the structure. They also provide convenient access for routine activities on the structure where permanent access is limited. Hook ladders can be made of metal or synthetic material (typically fiberglass).

10.1.4 Detachable climbing devices or steps

Detachable climbing devices or steps shall meet the following requirements:

—Detachable climbing devices shall be in accordance with 9.2.1.4.3, and typically, the detachable climbing devices are comprised of a number of step bolts attached to a square or rectangular steel bar with appropriate end fittings on the ends of the bar that fit into permanently installed clips on the structure. The size and weight of the ladder is such that one climber alone can install or remove it from the structure.

—When detachable steps or climbing devices are used, the climbing device or steps shall be engaged into the structure attachment point(s). The spacing between detachable steps shall not exceed 914 mm (36 in) on any one side, and shall be spaced at 457 mm (18 in) intervals.

10.1.5 Working or transition platforms

Permanent attached working or transition platforms shall meet the following requirements:

—Provide enough working space. The minimum platform width shall be not less than 457 mm (18 in).

—Platforms on elevated structures and the connections shall be capable of supporting their maximum intended live load and their own structure weights. Platforms shall also be designed for the effects resulting from the supporting structure deflections.

—Platforms shall not have open edge width more than 457 mm (18 in). Otherwise, either guard rails, lifelines, or anchorage points shall be provided to eliminate any potential fall hazards.

11. Special conditions

11.1 General

Equipment identified in this clause applies to both energized and non-energized facilities. This includes equipment utilized by line clearance tree trimmers. Live work demands the dielectric integrity of fall protection devices be confirmed when the possibility exists of either inadvertent or planned entry inside the electrical Minimum Approach Distance.

In addition to the task of climbing, resting, and work positioning at the worksite, it is imperative the fall protection method selected be compatible with the specific work being performed and/or the prevailing conditions. Many elements of a fall protection system used on de-energized work may not be suitable for energized, storm damage, or inclement weather work.

The specific requirements for devices used by tree trimmers are covered in ANSI Z133.1–2001.

11.1.1 Selecting an energized work method

When selecting an energized work method to perform work on or near energized facilities at an elevated work position, consideration shall be given to:

—Method of reaching the elevated position and returning to the ground (see IEEE Std 516).

—The fall protection system.

The fall protection systems used shall not compromise the climber's insulated position. A key element to bare-hand work is access to the final work position. Access to the work position can be accomplished by one or more of the following:

—Insulating aerial device

—Insulating hot sticks (ASTM F711)

—Nonconductive rope

—Insulating ladder

—Insulating platform

—Insulating tower boom

—Helicopter

Fall protection equipment shall not violate electrical minimum approach distances.

NOTE—The basic live work methods to be considered are discussed in IEEE Std 516.

11.2 Clearance to energized facilities for tree trimming

When trimming trees in proximity to energized facilities, the working distance shall be in accordance with OSHA 1910.269(r).

Fall protection devices used in these circumstances shall not reduce the electrical Minimum Approach Distances of NESC Rule 441 for competent climbers.

11.3 Storm damage and inclement weather

11.3.1 Storm damage

Thorough inspection of suspected or visually damaged facilities shall precede any climbing or work activity. Stresses that may have exceeded design limitations require engineering evaluation. Competent climbers shall inspect all climbing surfaces for damage to permanently attached facilities such as step bolts, rungs, working rings, attachment fixtures, and welds. In particular, the structural integrity of the anchorages for attaching fall protection systems shall be carefully scrutinized. In addition, other hazards (trees, buildings, adjacent structures, etc.) that may fall into or affect the structure's stability shall be analyzed before work is started on the structure.

11.3.2 Inclement weather

Weather conditions may adversely affect climbers and climbing surfaces. Prevailing local conditions (e.g., wind, ice, rain, and slippery surfaces) shall be considered in the selection of climbing methods and equipment. Actions shall be taken to minimize the effects of wet, icy, muddy, or slippery handholds and stepping surfaces; these actions can include chipping ice from surfaces, or wearing anti-slip gloves and/or boots.

12. Precautions

12.1 General

Manufacturers' recommendations shall be understood and followed in addition to employer requirements for the inspection, care, use, and maintenance of fall protection equipment.

12.2 Work positioning equipment

One hundred percent leather work positioning straps and line worker's body belt buckle attachments shall not be used.

Work positioning straps that have a wear indicator and the rated strength required by this standard shall be used.

12.3 Accidental disengagement

Accidental disengagement is the sudden, unexpected release of a work positioning strap snap hook from the D-ring of the line worker's body belt, without the user directly manipulating the latch of the snap hook.

Connecting hardware shall be dimensionally compatible with the member to which they are connected to prevent unintentional disengagement of the connection. Consider using snap hooks with 16.0 KN (3600 lb) gate hooks to minimize side loading failure. For more information, see ANSI Z359.12.

The possibility exists for some snap hooks to roll out of D-rings. When multiple locking snap hooks are attached to a single D-ring, they shall be evaluated in the combination to be used. Locking snap hooks reduce the possibility for roll-out.

Snap hooks shall not be connected to each other.

The employee shall determine that all components of the fall protection system are properly engaged and that the employee is secure in the line worker's body belt, harness, or other fall protection equipment.

12.4 Line worker's body belt flip-out

The line worker's body belt shall be worn in such a way as to prevent flip-out. The use of gut straps or suspenders, or other methods should be used to minimize the risk of the worker flipping out.

12.5 Lanyards

All lanyards used for fall arrest shall have an energy absorber.

For all leading edge applications, select lanyard line material that does not cut, abrade, or separate should the user fall over the edge.

12.6 Horizontal lifelines

Horizontal lifelines shall be designed and installed per the manufacturer's recommendations.

Annex A

(informative)

Elements of fall protection systems

Fall protection systems include all of the elements required to prevent a climber from falling or, should a fall occur, to arrest the forces on the climber's body to prescribed limits. A fall protection system includes the following components:

—Competent climber (continuous attachment).

—Inspection and care of equipment.

—Proper selection and application of equipment.

—Fall protection system (hardware). A fall protection system consists of three basic elements:

—An anchorage designed to support the loads required for a fall prevention or arrest system (including rigging and workloads).

—A climber's body attachment.

—A means of connecting the body attachment to the anchorage.

The two types of fall protection systems are:

a) *Fall prevention system*: A fall prevention system prevents the climber from falling from one elevation to another elevation. Some examples of components that may be included in a fall prevention system include:

1) Anchorage.
2) Non-energy absorbing lanyard with attaching hardware (fixed length or adjustable).
3) Work positioning strap (see NOTE below).
4) Rated connecting hardware.
5) Harness.
6) Line worker's body belt.
7) Guard railing.

The competent climber requirements shall be met where work positioning devices do not guarantee fall prevention or protection. The work positioning strap connectors shall not be in the same D-ring when around an anchorage or pole while in work or rest position.

NOTE—Line worker's body belts with work positioning straps are considered to be work positioning devices in cases such as climbing poles.

b) *Fall arrest system*: A fall arrest system is designed to arrest the climber in the event of a fall. Considered in a fall arrest are the length of fall and the action of any energy-absorbing device incorporated in the system. Some examples of components that may be included in a fall arrest system are:

1) SRD (Retractable lifeline or lanyard)
2) Lanyard with energy absorber
3) Lifeline with rope-grab
4) Rated connecting hardware

5) Harness

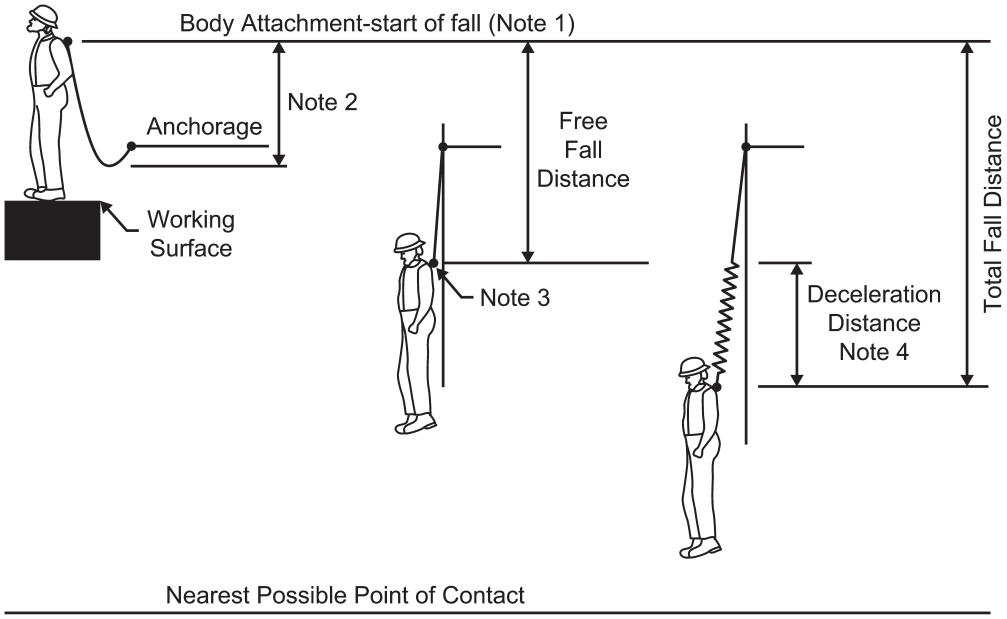
6) Anchorage

Annex B

(informative)

Components of an arrested fall

The following illustration provides an example of how each component of a fall arrest system interacts with each other and the corresponding fall distance of each.



NOTE 1—The anchorage should be above the body attachment point; however, this may not always be possible, e.g., when attaching to a lattice member or substation electrical equipment.

NOTE 2—The lanyard slack and distance between the body and anchorage attachments shall be included in the fall arrest system design for each specific use.

NOTE 3—The movement of the D-Ring from its slack position to deceleration on set is included in the free-fall distance [1.83 m (6 ft) maximum].

NOTE 4—The deceleration distance plus the distance from the body attachment to the nearest possible point of contact is included in the fall arrest system design for each specific use.

Figure B.1—Components of an arrested fall

Annex C

(informative)

Critical fall situations

C.1 Wood structures

During work on wood poles, the following conditions described in C.1.1 through C.1.3 may be encountered and create the potential for a fall while climbing, transitioning, and changing position and/or work location. These conditions should be addressed in the training required for competent climbers.

C.1.1 Condition of poles

Condition of poles are described as follows:

—Knots/knotholes

—Broken pole

—Burnt pole

—Weather checks

—Splinters

—Rotted outer surface

—Crooked/leaning poles

—Wet/icy conditions

—Conditions created by wood preservatives

—Contaminants

C.1.2 Obstruction on poles

Obstructions on poles may include some of the following:

—Conduits or cable attachments

—Nails/tacks

—Communication cables/wires

—Ground wires and moldings

—Signs/posters

—Pole numbers and date nails

—Insect nests

—Metering equipment

—Guy wires/crossarms/other attachments

—Line hardware

—Solar panels

—Line equipment (transformers, capacitors, switches, regulators, etc.)

—Structure modifications that impede the ability to climb and create a hazard

C.1.3 Climbing practices

Some climbing considerations include:

—Ascending or descending too rapidly

—Climbing low side of pole

—Climbing too close to the pole

—Climbing through unprotected/uncovered conductors

—Improperly sharpened climbing gaffs

—Inattention while ascending or descending

—Belting off at an improper position

—Holding onto hardware

—Standing on hardware

—Improper climbing techniques (cut-outs of climbing hooks, roll-outs on snap hooks/work positioning strap)

C.2 Lattice steel structure

During work on lattice steel structures, the following conditions may be encountered which could create the potential for a fall while climbing, transitioning, or changing position and/or work location. These conditions should be addressed in the training required for competent climbers.

—Moving on diagonal members and when transitioning through the bridge

—Loose or weak step bolts

—Permanent fixed ladders

—Temporary ladders

—Structure design (extended spacing between steps)

—Deterioration of step bolt or rung strength

—Weather conditions (cold, wind, ice, wet, mud)

—Excessively rough or sharp surfaces that can catch clothing or cut the climber

—Loose steel members

—Structure modifications that create a hazard and impede the ability to climb

C.3 Tubular steel, concrete, guyed, composite, and special purpose structures

During work on tubular steel, concrete, guyed, composite, and special purpose structures, the following conditions may be encountered and create the potential for a fall while climbing, transitioning, or changing position and/or work location. These conditions should be addressed in the training required for competent climbers.

—Permanently installed ladders and rungs

—Loose or weak step bolts

—Temporary ladders and step bolts

—Temporary platforms

—Weather conditions (cold, wind, ice, wet, mud)

—Structure modifications that impede the ability to climb and create a hazard

C.4 Personal clothing

The following conditions in a climber's clothing could create a potential hazard while climbing. These conditions should be addressed prior to climbing.

—Worn or loose heels/soles on climbing boots

—Loose or torn clothing

—Improper size gloves

—Holes in gloves

—Slippery type clothing (nylon, polyester, etc.)

—Grease/oil on gloves

Annex D

(informative)

Bibliography

Bibliographical references are resources that provide additional or helpful material but do not need to be understood or used to implement this standard. Reference to these resources is made for informational use only.

[B1] 29 CFR 1915.159, Personal Fall Arrest Systems.

[B2] ANSI A14.5, Safety Requirements for Portable Reinforced Plastic Ladders.

[B3] ANSI A92.2, Vehicle Mounted Elevating and Rotating Aerial Devices (SIA).

[B4] ANSI A92.3, Elevating Work Platforms, Manually Propelled (SIA).

[B5] ANSI A92.5, Boom-Supported Elevated Work Platforms (SIA).

[B6] ANSI A92.6, Work Platforms, Self Propelled Elevating (SIA).

[B7] ANSI Z133.1, Arboricultural Operations Safety.

[B8] Ellis, J. Nigel, and Howard B. Lewis, *Introduction to Fall Protection, Appendix A-4: Equipment Installation Guide*, American Society of Safety Engineers.

Consensus

WE BUILD IT.

Connect with us on:

Facebook: https://www.facebook.com/ieeesa

Twitter: @ieeesa

LinkedIn: http://www.linkedin.com/groups/IEEESA-Official-IEEE-Standards-Association-1791118

IEEE-SA Standards Insight blog: http://standardsinsight.com

YouTube: IEEE-SA Channel

IEEE
standards.ieee.org
Phone: +1 732 981 0060 Fax: +1 732 562 1571