

IEEE Trial Use Guide for Fall Protection for the Utility Industry

Sponsor

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

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

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Introduction

(This introduction is not part of IEEE Std 1307-1996, IEEE Trial Use Guide for Fall Protection for the Utility Industry.)

Fall protection equipment, work methods, and training for working in elevated positions has been applied to industry in general. Utilities are a very small and specialized part of general industry and therefore require specialized climbing practices. Federal regulations proposed in 1989 caused the utility industry to realize that general industry regulations were impractical when applied to utility structures and climbing practices. This guide was established to provide fall protection applications that are specific to the utility industry.

Injuries and death from falls have long been the concern of every worker and employer whose work involves worksites at elevated locations. As data has been accumulated regarding falls, it has been recognized that falls occurred because protective equipment, regardless of how minimal or inadequate, was ignored or misused. Workers died or sustained serious injury because they were not trained to use, or simply decided they did not need to use, fall protection. Today, in most areas of the utility industry, employers have mandatory requirements regarding the use of fall protection in accordance with current accepted practice. Together, modern day equipment and training can minimize the risk of a worker falling.

This guide was written by the Utility Climbing Task Force, 15.07.05.06, of the Working Group on Work Methods, 15.07.05, of the IEEE Engineering in the Safety, Maintenance, and Operations of Lines (ESMOL) Subcommittee, 15.07. It includes contributions from Subcommittee 8, Part 4, Working Rules of Accredited Standards Committee C2-1997, National Electrical Safety Code[®] (NESC[®]), as well as persons from other national committees and organizations.

During preparation of IEEE Std 1307-1996, the Working Group lost a significant contributor to the project through the death of Joseph M. Van Name. Mr. Van Name was highly instrumental in the coordination process required to guide the project to completion. The Working Group wishes to acknowledge their grateful appreciation for the contribution made by Mr. Van Name.

At the time this guide was completed, the IEEE/ESMOL Task Force 15.07.05.06 on Utility Climbing had the following membership:

Harold J. Fox, Chair

G. K. Brandt
J. L. Bronnert
K. Buchholz
T. Buonincontri
W. T. Croker
J. F. Doering

J. L. Dushaw
M. Eby
E. L. Harris
H. J. Kientz
G. Kiser
A. L. Lewis
T. Lucas

J. D. Mitchell
J. L. Price
D. Reisinger
G. E. Stinnett
J. M. Van Name*
R. M. Wagner

*Deceased

Working in parallel with the IEEE/ESMOL Task Force was NESC-SC8 Working Group 08.02 on Fall Protection, which at the time this guide was completed had the following membership:

J. M. Van Name, Chair*

J. L. Dushaw, Vice Chair

H. J. Kientz, Secretary

K. Buchholz
V. Casini
J. M. Degen
D. Fankhouser
H. J. Fox
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J. Pipkin

D. Reisinger
T. Schmidt
T. Smith
P. Stiegler
D. Stronach
R. M. Wagner
D. M. Wallis
H. D. Wilcox
H. Williams
W. Marsh

*Deceased

Other individuals who have contributed review and comments and who were forwarded copies for information and comments only are as follows:

B. Cannon
J. Christensen
M. Clever

K. Kuehn
M. McDonough
W. Million*

T. Rasler
S. Theis
J. R. Tomaseski

*Deceased

When the IEEE Standards Board approved this standard on 20 June 1996, it had the following membership:

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IEEE Trial Use Guide for Fall Protection for the Utility Industry

1. Overview

1.1 Scope

This guide provides general recommendations for a fall protection program for substation and generation structures and equipment, communication [including Community Antenna Television (CATV)], transmission, and distribution structures. It is not intended to include all of the proven practical methods and procedures; however, these selected comprehensive recommendations are based on sound engineering principles, engineering safety considerations, and research into the tools, methods, practices, and training provided to and by electric power and communications workers.

This guide applies to electric distribution, transmission, and generation work, communications work (including CATV), line clearance tree trimming work (tree work performed from an aerial lift device or from a ladder), and structure painting. It does not include work in vaults, manholes, or other confined spaces. Requirements regarding floors and similar surfaces, stairways, guardrail systems, and scaffolding of all types are not considered in this guide.

1.2 Purpose

The purpose of this guide is to provide emphasis to encourage further development in equipment, work methods, and training relating to fall protection programs within the utility industry.

This guide provides recommendations to allow qualified climbers latitude to climb about unattached on a structure while requiring non-qualified climbers to be attached by a fall protection system.

1.3 Application

This guide is broad yet specific enough to apply to the fall protection of personnel climbing and working at a variety of elevated worksites considered for the utility industry. Since fall prevention and protection practices for different circumstances are influenced by the nature of the circumstance, care shall be exercised when applying these practices to a specific job and location.

1.4 Other requirements

The procedures presented herein are intended to clarify and enhance other national, state, and local regulations and to add specific requirements applicable to the utility industry. They are not intended to replace their respective regulations. The rules of the administrative authority shall take precedence if a conflict exists between this guide and the administrative authority's rules.

2. References

This guide shall be used in conjunction with the following publications. When the following standards are superseded by an approved revision, the revision shall apply. In case of disagreement between this guide and a referenced standard, this guide shall govern.

Accredited Standards Committee C2-1997, National Electrical Safety Code® (NESC®).¹

ANSI A10.8-1988, Safety Requirements for Construction and Demolition Operations—Scaffolding.²

ANSI A10.14-1991, Construction and Demolition Operations—Requirements for Safety Belts, Harnesses, Lanyards, and Lifelines for Construction and Demolition Use.

ANSI A14.1-1990, Safety Requirements for Portable Wood Ladders.

ANSI A14.2-1990, Safety Requirements for Portable Metal Ladders.

ANSI A14.3-1984, Safety Requirements for Fixed Ladders.

ANSI A92.2-1990, Vehicle Mounted Elevating and Rotating Aerial Devices (SIA).

ANSI A92.3-1990, Elevating Work Platforms, Manually Propelled (SIA).

ANSI A92.5-1992, Boom-Supported Elevated Work Platforms (SIA).

ANSI A92.6-1990, Work Platforms, Self Propelled Elevating (SIA).

ANSI Z133.1-1994, Safety Requirements for Tree Care Operations—Pruning, Trimming, Repairing, Maintaining, and Removing Trees, and Cutting.

ANSI Z359.1-1992, Safety Requirements for Personal Fall Arrest Systems, Subsystems, and Components.

ASTM F711-89, Specification for Fiberglass-Reinforced Plastic (FRP) Rod and Tube Used in Live-Line Tools.³

ASTM F887-91a, Standard Specifications for Personal Climbing Equipment—Pole and Tree Climbers.

ASTM F914-91, Standard Test Method for Acoustic Emission for Insulated Aerial Personnel Devices.

IEEE Std 516-1995, IEEE Guide for Maintenance Methods on Energized Power Lines (ANSI).⁴

¹The NESC® is available from the Institute of Electrical and Electronics Engineers, 445 Hoes Lane, P.O. Box 1331, Piscataway, NJ 08855-1331, USA.

²ANSI publications are available from the Sales Department, American National Standards Institute, 11 West 42nd Street, 13th Floor, New York, NY 10036, USA.

³ASTM publications are available from the American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959, USA.

⁴IEEE publications are available from the Institute of Electrical and Electronics Engineers, 445 Hoes Lane, P.O. Box 1331, Piscataway, NJ 08855-1331, USA.

3. Definitions

3.1 activation distance: The distance traveled by a fall arrester or the amount of line payed out by a self-retracting lanyard 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.

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

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

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

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

3.6 belt, aerial: A single *D-ring* belt designed for attachment when a worker is in an aerial bucket or platform.

3.7 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.

3.8 belt, bucket: *See: belt, aerial.*

3.9 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.

3.10 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. Three types of carbiners are described as follows:

- a) *Locking type* (required by this guide), with a self-closing, self-locking gate that remains closed and locked until intentionally unlocked and opened for connection or disconnection.
- b) *Non-locking type*, with a self-closing gate that remains closed, but not locked, until intentionally opened by the user for connection or disconnection.
- c) *Manual locking type*, with a self-closing gate that remains closed but not locked (unless purposely locked by the user) until intentionally opened by the user for connection or disconnection.

3.11 climber in training: A worker who is in training to become a qualified climber.

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

3.13 competent person: One who, because of training, experience, and authority is capable of identifying and correcting hazardous or dangerous conditions in the fall arrest system, or any component thereof under consideration, as well as its application and use with related equipment.

3.14 deceleration distance: The additional vertical distance a falling worker travels, excluding lifeline elongation and 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, aerial 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 worker comes to a stop.

3.15 detachable ladder: Those devices that are not permanently installed on a structure but are the normal means for accessing the structure and attached facilities.

3.16 detachable step: Those devices that are not permanently installed on a structure but are the normal means for accessing the structure and attached facilities.

3.17 D-ring: A connector used integrally in a line-worker's body belt, aerial belt, or full-body harness as an attachment element, and in lanyards, energy absorbers, lifelines and, non-permanent boom attachments. To be in accordance with ASTM F 887-91a.⁵

3.18 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 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. An energy absorber may be borne by the user (personal) or be a part of a horizontal lifeline subsystem or a vertical lifeline subsystem.

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

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

3.21 fall arrester: A device such as a rope grab that travels on a lifeline and will automatically engage the lifeline and lock so as to stop an accidental fall of a worker.

3.22 fall arrest system: The assemblage of equipment such as a line-worker's body belt, aerial belt, or full-body harness in conjunction with a connecting means, with or without an energy absorbing device, and an anchorage to limit the forces a worker experiences during a fall. A fall arrest system is designed to prevent a worker, in the process of a fall, from falling more than the designed fall limit. After January 1, 1998 a line-worker's body belt is prohibited from use as part of a fall arrest system.

3.23 fall clearance distance: The total fall distance plus the distances between the location of a line-worker's body belt or full-body harness attachment point under load and the nearest possible point of contact, plus the dynamic elongation.

3.24 fall prevention system: A system, which may include a positioning system, intended to prevent a worker from falling from an elevation. Such systems include positioning device systems, guardrail, barriers, and restraint systems. Fall prevention systems are used in an attempt to prevent workers from falling from an elevation.

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

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

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

3.28 force test: A test used to assure that the fall arrest system itself does not severely injure a worker during a fall arrest. A test to ensure that the worker is not severely injured by limiting forces on the worker's body to 4.0 kN (900 lb) with a line-worker's body belt or 8.0 kN (1800 lb) with a full-body harness.

⁵Information on references can be found in clause 2.

3.29 free-fall distance: The vertical displacement of a fall arrest attachment point on the line-worker's body belt, aerial belt, or 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 lifeline/lanyard extension before they operate and fall arrest forces occur. The component slack (D-ring slide) distance should be included in the free-fall distance.

3.30 harness: A component with a design of straps that is fastened about the worker in a manner so as 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. For the purposes of IEEE Std 1307-1996, the word *harness*, used by itself, refers to full-body harness.

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

3.32 karabiner: *See: carabiner.*

3.33 lanyard: A flexible line of webbing, rope, wire rope, or strap that generally has a connector at each end for connecting the line-worker's body belt, aerial belt, or full-body harness to a energy absorbing device, lifeline, or anchorage.

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

3.34 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). Serves as a means for connecting other components of a personal 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.

3.35 lineman's body belt: *See: belt, line-worker's body.*

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

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

3.38 parachute harness: An assembly of webbing, strapping, and attachments that permits the attachment of a support device (e.g., D-ring), and fits the human such that the entire weight of same can be supported without injury. The lanyard is constructed so that it will support the normal weight of a human, but can be released by pulling on a disconnection means. Upon this action, there will be separation of the body support assembly from the lanyard that has been attached to the harness, thus permitting the movement of the body support means from the human body support assembly. A parachute harness allows separation of the lanyard supporting assembly from an object, commonly an aircraft or helicopter. As released, the force to complete the full separation of the harness is of the order of one-third of that required to produce separation resulting from the actuation of the master (main) release (disconnection) means.

3.39 pin-on platform: A platform attached by a pin to a boom to support a worker at an elevated worksite. A platform is a device used to support the worker in a standing position (generally without sides).

3.40 pole strap: *See: positioning strap.*

3.41 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. The platform may have an anchorage point for a positioning strap.

3.42 positioning strap: A strap with snaphook(s) to connect to the D-rings of a line-worker's body belt or full-body harness. Used as a positioning device (also known as a *pole strap* or *safety strap*).

3.43 qualified climber: A worker who, by reason of training and experience, understands the methods and has routinely demonstrated proficiency in climbing techniques and is knowledgeable of the hazards associated with climbing.

3.44 qualified worker: A worker who has received, as part of a training program, formal instruction and training in the techniques for climbing and working on structures and/or equipment. A qualified worker will have satisfactorily completed and demonstrated proficiency in the climbing portion and technical aspects of a formal training program. Climbing may be included in routine work assignments. Examples of a qualified worker are engineers and technicians doing inspections, testing, communications installations, etc.

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

3.46 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 worker.

3.47 safety strap: See: **positioning strap**.

3.48 self-retracting lanyard: A device that contains a drum-wound line that may be slowly extracted from or retracted onto the drum under slight tension during normal movement of the user. The line has means for attachment to the fall arrest attachment on the body support. After onset of a fall, the device automatically locks the drum and arrests the fall. The device may have integral means for energy absorption.

3.49 skates: Devices used in the climbing of flanged structures.

3.50 snaphook: 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. Two types of snaphooks are described as follows:

- a) *Locking type*, with a self-closing, self-locking keeper that remains closed and locked until unlocked and pressed open for connection or disconnection.
- b) *Non-locking type*, with a self-closing keeper that remains closed until pressed open for connection or disconnection.

3.51 strength test: A test to ensure that components of the fall protection system will not fail when subjected to a 22.2 kN (5000 lb) force per worker, or to the design load of an engineered system.

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

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

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

3.55 unqualified climber: A worker that does not meet the requirements of a qualified climber.