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## Standard Practice for Industrial Rope Access<sup>1</sup>

This standard is issued under the fixed designation E2505; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

<sup>ε1</sup> NOTE—ANSI references in 2.1, 6.1, and 6.2 were corrected editorially in June 2018.

### INTRODUCTION

This standard applies where access is gained to structures, man-made or natural, by means of ropes suspended from the structure or the features concerned. It applies to cases where ropes are used (1) as the primary means of support, (2) as the means of primary protection or positioning, and (3) where operatives descend or ascend on a rope, or traverse along a tensioned horizontal rope where the use of hands and feet can no longer be used to fully support the body.

This standard is not intended to apply where rope access techniques are used by the fire department, other emergency services, and the armed forces. The authorities concerned with these activities have their own standards for such work.

This standard does not apply to other methods of working at height such as steeple jacking, suspended scaffolds, steelwork erection, or boatswain's chairs.

### 1. Scope

1.1 This practice provides a framework of practical and technical information within which the specifying authority and the operators using rope access techniques can develop effective arrangements to help ensure the safety and health of personnel involved in these projects.

1.2 This practice applies to the use of techniques whereby access is gained to structures, man-made or natural, by means of ropes suspended from the structure. It applies to all cases where ropes are used as the primary means of support and where persons descend or ascend a rope, or traverse along a tensioned horizontal or inclined rope.

1.3 This practice applies to all industrial uses of rope access techniques except use by the fire department and other emergency services for rescue work and training in connection therewith. Fire and rescue authorities have special procedures applicable to their circumstances. This standard does not apply to other methods of working at heights, such as suspended scaffolds.

1.4 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical

conversions to SI units that are provided for information only and are not considered standard.

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.6 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

### 2. Referenced Documents

2.1 *ANSI Standards:*<sup>2</sup>

[ANSI Z89.1 2003 Helmets](#)

[ANSI Z359.1 1992 Harnesses](#)

2.2 *OSHA Regulations (Standards—29 CFR):*<sup>3</sup>

[1910.66 App C Fall Protection System](#)

[1926.450 Scope, applications applicable to this subpart](#)

[1926.500 Scope, application, and definitions applicable to this subpart](#)

<sup>1</sup> This practice is under the jurisdiction of ASTM Committee E06 on Performance of Buildings and is the direct responsibility of Subcommittee E06.55 on Performance of Building Enclosures.

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<sup>2</sup> Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

<sup>3</sup> Available from Occupational Safety and Health Administration (OSHA), 200 Constitution Ave., NW, Washington, DC 20210, <http://www.osha.gov>.

1926.502 Fall Protection Systems Criteria and Practices

1926.503 Training Requirements

2.3 Other Standards:

CE EN361 & EN358 Harnesses<sup>4</sup>

Cordage Institute C11801 Low Stretch and Static Life Safety Rope<sup>5</sup>

NFPA 1983 Fire Service Life Safety Rope<sup>6</sup>

UIAA 101 & EN892 Standard/Testing for Dynamic Ropes<sup>4</sup>

### 3. Terminology

#### 3.1 Definitions:

3.1.1 *anchor, n*—a secure point of attachment having sufficient capacity to support elements of a *suspension system* or *fall protection system* (see *primary anchor* and *directional anchor*).

3.1.2 *ascender, n*—a type of rope grab designed to grip a rope firmly when loaded in one direction and which can slide freely along the rope in the opposite direction.

3.1.2.1 *Discussion*—Ascenders are used in pairs to ascend a working rope.

3.1.3 *ascent system, n*—a type of *suspension system* that allows a worker to ascend a *working rope*.

3.1.4 *basic rescue, v*—the unassisted controlled rescue of a coworker in an emergency using a combination of fall arrest ropes and *working ropes*.

3.1.5 *belay, v*—the active use of a rope, *anchor*, and friction system by a worker to arrest the fall of another worker.

3.1.6 *boatswain's chair, n*—a small sitting platform that is suspended on a multipart tackle, allowing the worker using the boatswain's chair to raise or lower the chair.

3.1.6.1 *Discussion*—A worker typically sits in a boatswain's chair without being directly attached to it (compare with swing seat).

3.1.7 *carabineer, n*—a type of connector formed as a complete loop and incorporating a spring-loaded entry gate. A locking carabineer includes a mechanism that prevents the entry gate from opening when the mechanism is engaged.

3.1.8 *chest harness, n*—an interconnected system of webbing straps, buckles and padding that is secured around the chest and shoulders and which should only be used in conjunction with a seat harness.

3.1.9 *competent person, n*—a person who has, through a combination of training, education, and experience, acquired knowledge and skills enabling that person to correctly perform a specified task or oversee a specified operation.

3.1.9.1 *Discussion*—A competent person is capable of identifying existing and predictable hazards related to specified tasks and operations and has authorization to take prompt corrective actions to eliminate those hazards [OSHA 1910.66 App. C Section I(b)].

<sup>4</sup> Available from the International Federation for Climbing and Mountaineering (UIAA), UIAA Office, Monbijoustrasse 61, Postfach CH-3000, Bern 14, Switzerland, <http://www.theuiaa.org>.

<sup>5</sup> Available from Cordage Institute, 994 Old Eagle School Road, Suite 1019, Wayne, PA 19087, <http://www.ropecord.com>.

<sup>6</sup> Available from National Fire Protection Association (NFPA), 1 Batterymarch Park, Quincy, MA 02169-7471, <http://www.nfpa.org>.

3.1.10 *connector, n*—a device used to couple (connect) together parts of a *fall protection system* or *suspension system*.

3.1.10.1 *Discussion*—A connector may be an independent component of the system, such as a *carabineer*, or it may be an integral component of part of the system, such as a buckle or D-ring sewn into a *seat harness*, or a snap hook sewn into a *lanyard* [OSHA 1926.500(b)].

3.1.11 *deceleration device, n*—any mechanism, such as a *back-up rope grab*, *energy-absorbing lanyard*, or other device that dissipates a substantial amount of energy during a fall arrest [OSHA 1926.500(b)].

3.1.12 *deceleration distance, n*—the additional vertical distance a falling worker travels, excluding safety rope elongation and free fall distance, before stopping, from the point at which the deceleration device begins to operate.

3.1.12.1 *Discussion*—Deceleration distance is measured as the distance between the location of a worker's harness attachment point at the moment of activation (at the onset of fall arrest forces) of the deceleration device during a fall, and the location of that attachment point after the worker comes to a full stop [OSHA 1926.500(b)].

3.1.13 *descender, n*—a device that acts as a friction brake on a *working rope*.

3.1.13.1 *Discussion*—It is attached directly to a *harness* with or without a *swing seat* to enable a worker to descend the rope in a controlled manner.

3.1.14 *descent system, n*—a type of *suspension system* that allows a worker to slide down a *working rope* in a controlled manner by means of a *descender*.

3.1.15 *directional anchor point, n*—a secure point used to redirect the path of a *working rope* and *safety rope* from a *primary anchor* attachment point to the edge of a structure.

3.1.15.1 *Discussion*—The redirected ropes are reeved through a pulley or carabineer, which is attached to the directional anchor. A directional anchor is necessary when no suitable anchor is available at a location directly above the intended worksite (compare with *primary anchor*) or to redirect ropes away from a potential hazard.

3.1.16 *dynamic rope, n*—a rope that is designed with energy absorbing characteristics which minimum criteria as defined by UIAA 101, Cordage Institute C11801 and conforms to OSHA minimum standards.

3.1.17 *energy-absorbing lanyard, n*—a *lanyard* that deforms in a controlled manner to absorb energy during a fall arrest while maintaining its ultimate tensile strength.

3.1.18 *failure, n*—breakage or separation of component parts [OSHA 1926.450(b)].

3.1.19 *fall factor, n*—the maximum distance a worker falls, divided by the length of the rope attaching the worker to the *anchor*.

3.1.20 *fall protection system, n*—a system used to arrest the descent of a worker in the event of a failure of the *suspension system*.

3.1.20.1 *Discussion*—A fall protection system consists of an *anchor*, *connectors*, and *harness*, as well as a *safety rope*,

*lanyard*, and *backup rope grab* or an active *belay* provided by another worker [OSHA 1926.500(b)].

3.1.21 *free fall*, *n*—the act of falling before the *fall protection system* begins to apply force to arrest the fall [OSHA 1926.500(b)].

3.1.22 *free fall distance*, *n*—the vertical displacement of the fall arrest attachment point on the worker’s harness between the onset of the fall and just before the system begins to apply force to arrest the fall.

3.1.23 *full-body harness*, *n*—an interconnected system of webbing straps, buckles, and padding that is secured around the body of a worker to distribute fall arrest forces over the thighs, pelvis, waist, chest, and shoulders. A seat harness combined with a connected chest harness is considered a full-body harness.

3.1.24 *harness*, *n*—an assembly of webbing straps that encircle a worker’s body and bears directly the weight of a worker who is using a *suspension system*, or which bears the weight of a worker during fall arrest or while working if a swing seat is not used (also see: *full-body harness*, *seat harness* and *chest harness*).

3.1.25 *impact load*, *n*—the dynamic forces applied to a *fall protection* or *suspension system* during the arrest of a *free fall*.

3.1.26 *industrial rope access*, *n*—the techniques by which rope systems are used to gain access to structures, man-made or natural. This definition includes all cases where ropes are used as both the primary means of support and as fall protection.

3.1.27 *kernmantle rope*, *n*—a rope consisting of an internal, load-bearing core covered by a separately woven sheath designed to protect the core from abrasion.

3.1.28 *lanyard*, *n*—a length of rope or webbing used to connect a worker’s *harness* to an *anchor* or *rope grab* [OSHA 1926.500(b)].

3.1.29 *locking carabineer*, *n*—a type of *carabineer* that includes a mechanism that prevents the entry gate from opening when the mechanism is engaged.

3.1.30 *lowering system*, *n*—a system that enables a worker to use an *anchor*, rope, and friction brake to lower another worker in a controlled manner. Lowering systems are typically used during rescue operations.

3.1.31 *maximum intended load*, *n*—the total load of the worker, tools, equipment, materials, transmitted loads, and other loads reasonably anticipated to be applied to the suspension system [OSHA 1926.450(b)].

3.1.32 *primary anchor point*, *n*—a secure attachment point having sufficient capacity to support a *suspension system* or *fall protection system* (compare with *directional anchor point*).

3.1.33 *rated strength*, *n*—the minimum tensile strength specified by the manufacturer of a piece of equipment or component.

3.1.33.1 *Discussion*—The rope minimum breaking strength shall be determined by subtracting three standard deviations from the mean result of five samples.

3.1.34 *rope grab, back-up type, n*—a device that can be made to slide along a safety rope and whose purpose is to arrest the fall of a worker in case of any failure in the *suspension system*.

3.1.35 *safety factor, n*—a multiple applied to a *maximum intended load* that provides for additional capacity in a rigging system.

3.1.36 *safety rope, n*—a rope connected to an *anchor* used to arrest a fall in case of the failure of a *suspension system*.

3.1.36.1 *Discussion*—A safety rope is a primary component of a *fall protection system*. Also known as a *lifeline*, *back-up rope*, or *secondary rope*.

3.1.37 *seat harness, n*—an interconnected system of webbing straps, buckles, and padding that is secured around the body of a worker to distribute fall arrest forces over the thighs, pelvis, and waist.

3.1.38 *static rope, n*—a rope exhibiting relatively low stretch under load and having only a limited ability to absorb energy during fall arrest as defined by the Cordage Institute C11801.

3.1.38.1 *Discussion*—Also known as *low-stretch rope* (compare with *dynamic rope*).

3.1.39 *suspension system, n*—the rigging system intended to bear the weight of a worker during the course of normal operations.

3.1.39.1 *Discussion*—A suspension system typically consists of a *working rope* and a *descender* or two *ascenders*, *lanyards*, and a *full-body harness* or *seat harness*. *Ascent systems* and *descent systems* are two types of *suspension systems*.

3.1.40 *swing seat, n*—a small sitting platform provided for the comfort of a worker.

3.1.40.1 *Discussion*—While using a swing seat, a worker also uses a *harness* that is attached directly to the *suspension system* (compare with *boatswain’s chair*).

3.1.41 *working rope, n*—a rope connected to an anchor and used for the primary support during the descent and ascent of the worker.

3.1.41.1 *Discussion*—A working rope is the principle component of a suspension system. Also known as a *main rope* or *suspension rope* and is always used in conjunction with a *safety rope*.

## 4. Significance and Use

4.1 Access to the exterior and interior of structures is often required as part of maintenance or inspection work. Depending on the characteristics of the structure and site constraints, access can often be achieved using a number of methods other than industrial rope access, including ladders, stationary or removable suspended scaffolding, mechanical self-propelled aerial lifts, and other suitable means. There are instances where use of such means of access is not feasible or economical.

4.2 This standard provides guidance on the use of rope access as an alternative to other methods of access.



## 5. Personnel and Training

5.1 *General Requirements for Personnel* (See OSHA 1926.503):

5.1.1 Industrial rope access workers shall be at least 18 years of age.

5.1.2 Physical fitness for industrial access workers:

5.1.2.1 Industrial rope access workers shall pass a general physical test administered by a physician that declares the worker medically fit.

5.1.2.2 The medical examination shall be performed every three years or after every recent major injury or illness. Workers will self-certify their fitness on an annual basis. Employers shall only authorize rope access work for personnel who are declared physically fit.

5.1.2.3 Workers shall have no recent injuries that could impair their ability to perform their responsibilities.

5.1.2.4 Workers shall not take any medication that can impair alertness or motor skills while performing rope access duties.

5.1.2.5 The physical fitness of workers shall be evaluated by the rope access supervisor prior to work.

5.2 Qualification levels for industrial rope access workers shall be based on a combination of training, experience, and competency. There are three internationally recognized qualification levels for industrial rope access technicians. An individual with Level 1 has the least and one with Level 3 has the most training, experience, and competency to perform the work as a rope access technician. The qualifications are outlined in **Appendix X1**.

5.3 *Working Teams:*

5.3.1 Rope-access workers shall work in teams, each consisting of at least two certified rope access technicians. Personnel that are not certified in rope access are not counted as part of a rope access team.

5.3.2 At least one member of a rope access team shall be a Level 3 worker.

5.3.3 There shall be no more than six Level 1 and Level 2 workers supervised by one Level 3 worker. The Senior Level 3 worker shall determine if this ratio needs to be decreased.

5.3.4 A Level 3 worker shall be responsible for the direct supervision and guidance of unqualified personnel that are required to perform tasks alongside the rope access team. The Level 3 worker is the primary authority when deciding on the suitability and safety of unqualified personnel that perform tasks using rope access. The presence of unqualified personnel who are under the supervision of a Level 3 worker should only be for short periods of time to monitor/inspect tasks or participate in minor tasks.

5.4 *Training:*

5.4.1 All rope access workers shall be trained to a syllabus and assessed on the requirements of the various rope access levels. Such training shall be provided by an independent competent organization or individual to ensure that the training standard is to an accepted externally certified level (see **Appendix X2**).

5.4.2 Competency in rope access techniques is gained through hands-on experience and improvement in the various

required skills. Lower level workers shall always be under the direct or close supervision of a supervisor.

5.4.3 All rope access workers shall maintain a record of their training and experience signed by a supervisor. Such records will be used for verification and preliminary assessment of an individual.

## 6. Industrial Rope Access Equipment

6.1 A helmet meeting the requirements of the ANSI Z89.1 and other appropriate standards that addresses multi-directional impact as well as an appropriate means for keeping the helmet on the head shall be worn during all industrial rope access work.

6.2 A full body harness meeting the requirements of ANSI Z359.1, NFPA 1983, CE EN 361, EN 358 and other appropriate standards shall be worn during all industrial rope access work.

6.3 *Connectors:*

6.3.1 Connectors used in the construction of fall protection systems or suspension systems shall:

6.3.1.1 Have a rated strength of at least 5000 lb (22.2 kN) [OSHA 1926.502(d)(1)];

6.3.1.2 Be intended by the manufacturer to be used for the support of personnel; and

6.3.1.3 Incorporate a locking mechanism that prevents unintentional disengagement of the connector [OSHA 1926.502(d) (5)].

6.4 *Lanyards:*

6.4.1 Lanyards used in fall protection systems shall:

6.4.1.1 Be constructed of synthetic fibers;

6.4.1.2 Have a maximum length that, when loaded by the weight of the operator, enables the operator to reach and operate the device to which the lanyard is attached; and

6.4.1.3 Have a minimum breaking strength of 5000 lb (22.2 kN) [OSHA 1926.502(d) (9)].

6.4.2 An energy-absorbing lanyard shall have a rated strength of at least 5000 lb (22.2 kN) when fully extended [OSHA 1926.502(d) (13)].

6.5 *Backup Rope Grabs:*

6.5.1 Backup rope grabs used in fall protection systems shall:

6.5.1.1 Automatically grip the safety rope in the event of either a fall or a failure of the suspension system;

6.5.1.2 Incorporate a means of preventing unintentional removal from the safety rope;

6.5.1.3 Be permanently marked by the manufacturer showing the maximum and minimum rope diameters suitable for use with the device; and

6.5.1.4 Be permanently marked by the manufacturer showing details, where necessary, of the correct orientation in which the device is to be installed.

6.6 *Descenders:*

6.6.1 A descender shall be manufactured specifically to control the rate of descent of a person sliding down a working rope.

6.6.2 A descender used for work-level suspension shall: