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Fall Protection or Base Jumping: Vertical Lifelines on the Job Site

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Introduction

Vertical lifelines (hereafter VLLs) are a commonly used fall protection system due to their versatile nature and accessibility. However, because of improper use and lack of proper training, the protection provided by this system is often nullified.

The most common misconceptions of the VLL system are its application, training requirements, compatibility with work activities and other fall protection system components, and its use as a rigid rail versus a flexible lifeline. In addition, the design criteria, which should be used by manufacturers and Qualified Persons, is a critical element in purchasing and using a safe vertical lifeline system.

Design Guidelines

Vertical lifeline connectors must meet Z359.12-2009 requirements. These requirements include the following:

1. End stop with sufficient strength to keep fall arrestor from falling off the end.

2. Knots are not allowed as lanyard end terminations.

3. Twenty-two percent (22%) is the maximum elastic elongation allowed for synthetic rope lifelines. Synthetic lifelines also need to have strength that is equivalent or superior to polyamides.

4. Wire rope lifelines have to have a diameter of at least 0.3125 inches to ensure they are compatible with Type 1 fall arrestors (i.e., designed to be used with VLLs). Wire rope lifelines must also have a breaking strength of at least 6,000 pounds.

5. All subsystem components must have a breaking strength of at least 5,000 pounds.

6. Fall arresters should lock and remain locked until released, and they must keep the arrest distance to 54 inches or less.

ANSI notes: "*The elastic deformation of the test anchorage and test anchorage connector may be determined by means of theoretical calculations performed and certified by a qualified person*."[1]

Testing should include the use of two 220-pound weights for dynamic performance or two 300-pound weights for dynamic strength. ANSI is also looking at adopting the torso-shaped test weight of 220 pounds found in CSA Z259.10-M90. This would allow for testing that would consider the fall direction that could inhibit equipment from being effective, such as rope grabs.

Training Requirements for the Life Cycle of the System

The Competent Person, as defined by OSHA 1926.32 and the proposed subpart D, must be properly trained to foresee potential and existing fall hazards. Unfortunately, the Competent Person designation often is simply assigned to the most skilled person, such as the foreman or the supervisor, regardless of whether this individual has the necessary fall protection training and experience to fulfill the responsibilities. While these individuals may have extensive knowledge and experience in general industry safety, their experience with fall protection methodology may be very limited. Therefore, employers must ensure their company's "Competent Person" receives adequate training before functioning in this role.

The Competent Person role is a significant area of responsibility and is an area that is critical to the success of the overall fall protection program. Proposed subpart D echoes the importance of being adequately trained and now requires that "the employer must ensure that each employee is trained by a Qualified Person."[2] Without completing a comprehensive Competent Person training program, it will be impossible for an employer's representative to properly and effectively perform this job function.

Every project activity, whether it is construction, renovation, demolition or process management, is an opportunity to economically maximize the safety performance of the final product. How can a company be "sustainable" if it does not incorporate the safety of the people who construct, maintain and use its facilities, machines and processes into the core of its business operations? The Sustainable Safety methodology creates a healthier and more efficient environment and protects personnel from foreseeable workplace hazards.

A key element to Sustainable Safety is the certification of each participant in the ability to identify and address foreseeable hazards with effective countermeasure integration. Sustainable Safety advances the relationship between safety, business, construction, maintenance and operation activities. It provides a safety strategy to the design team, owners and managers for the incorporation of continuous employee safety into designs, products, educational programs and services.

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[1] American National Standards Institute (ANSI). 2009. *Connecting Components for Personal Fall Arrest Systems* (ANSI/ASSE Z359.12-2009, E4.1.1). Des Plaines, IL: American Society of Safety Engineers (ASSE).

[2] Occupational Safety and Health Administration (OSHA): Federal Registers. May 24, 2010. Proposed Rules. Federal Register No. 75:28861–29153, *Walking-Working Surfaces and Personal Protective Equipment (Fall Protection Systems); Proposed Rule* (retrieved December 1, 2010) (http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=FEDERAL_REGISTER&p_id=21518).

Certified building planners, design engineers and design architects become aware of and consider, at the conceptual stage, the personal safety of the project's construction, maintenance and operation personnel and their equipment as they create their projects. Sustainable Safety certified building managers will have clearly defined policies and safety procedures established, implemented and enforced throughout the project lifecycle.

The result of implementing Sustainable Safety methodologies is that the work process, equipment and procedures have already been addressed before we have even reached the training requirements of the Authorized Person who will be on the VLL system. This preplanned approach helps to ensure that VLLs will be used only for their intended purpose and with an understanding of their limitation by trained employees.

ANSI Z359 lays out the training requirements for us. These training requirements include the following:

- How to use the equipment.
- How to put on the equipment.
- How to hook up to compatible equipment.
- How to determine if the equipment will be effective protection.
- How respond to a fall.
- How to rescue a victim.
- How to summon for help.

These tasks require preplanning, because if you don't have a rescue plan in place for your work-at-heights activities, how will you train on rescue?

As mentioned above, in proposed subparts D and I for general industry, OSHA requires that training be conducted by a Qualified Person and stipulates four areas on which every employee exposed to a fall hazard must be trained. Three of the four areas closely resemble the requirements laid out in 1926.503, with the last one simply combining some of the requirements from 1926 subpart M while expanding the requirement of training on the limitations. Training must be provided on:

1. The nature of fall hazards in the work area;
2. The correct procedures for erecting, maintaining, disassembling, and inspecting the fall protection systems to be used;
3. The use and operation of guardrail systems, safety net systems, warning lines used in designated areas, and other protection;
4. The use, operation, and limitations of personal fall protection systems, including proper hook-up, anchoring and tie-off techniques, methods of use, and proper methods of equipment inspection and storage as recommended by the manufacturer.

Take the requirements of ANSI Z359, OSHA 1910 and OSHA 1926 and combine them with a Sustainable Safety approach of preplanning the use of VLLs and an understanding of the benefits as well as the hazards of VLLs will begin to emerge. An employee who understands fall speeds and clearance requirements is much less likely to do things such as allowing their rope grab to rest below their feet and risk a free fall of greater than six feet.

Identifying the Limitations and Proper Use of Vertical Lifelines

VLLs and rope access have a complex relationship. Often misuse stems from combining or crossing the guidance given to these two very different systems.

ANSI (Z359.0-2007) defines VLLs, VLL subsystems, and rope access as follows:

Vertical lifeline: "A component, element or constituent of a lifeline subsystem consisting of a vertically suspended flexible line and along which a fall arrester travels."[3]

Vertical lifeline subsystem: "An assembly, including the necessary connectors, comprised of a vertical lifeline component and, optionally, an energy absorber and a lifeline tensioner component."[4]

Rope access: "A technique using safety ropes, normally incorporating two separately secured systems, one as a means of access and the other as a secondary system, used with a harness in combination with other devices, for access to and from as well as suspension at the place of work."[5]

A clear understanding of the requirements for each system will ensure that, when called upon in the event of a fall, the VLL will perform its job. Never confuse which system is the secondary fall protection system.

When utilizing a VLL, key information needed by the user includes:

- the length of the system,
- the material of which it is constructed,
- the diameter of the lifeline, and
- the elongation characteristics.

Properly trained employees must also make sure they follow the manufacturer's installation requirements for the particular system and only use compatible components.

Once a user has the above information, they must be able to utilize it to ensure that they are 100 percent protected once they reach the trigger height for requiring fall protection. If you consider the fact that many VLLs will have an elongation of up to 22 percent, the importance of understanding that a VLL attached to an anchorage 100 feet above the ground may not provide adequate protection until the member is 22 feet in the air becomes clear.

Users must also understand that sharp edges, knots, and exposure to chemicals or weather can all limit or reduce the strength of the system. It is vital that these systems be inspected periodically, at least once a year or more.

The proper use of VLLs can also be confusing simply by the atmosphere that is common in the industries that utilize them. Take for example the roofing industry and their use of VLLs for fall protection. Many times the lack of training or understanding of the system leads to abuse of the system. Multiple employees may tie off to a system, but it is dangerous and is not recommended. OSHA explains by stating: "Vertical lifeline considerations. As required by Sec.

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[3] American National Standards Institute (ANSI). 2007. *Fall Protection Code: Definitions and Nomenclature Used for Fall Protection and Fall Arrest* (ANSI/ASSE Z359.0-2007). Des Plaines, IL: American Society of Safety Engineers (ASSE).
[4] Ibid.
[5] Ibid.

1910.140(c)(3), each employee must have a separate lifeline when the lifeline is vertical. If multiple tie-offs to a single lifeline are used, and one employee falls, the movement of the lifeline during the arrest of the fall may pull other employees' lanyards, causing them to fall as well."[6]

Summary

Understanding the complex nature of VLLs in both their testing and multiple uses is crucial to establishing a proper VLL safety policy that promotes Sustainable Safety. Vertical lifelines' history of wide use and mass appeal due to low costs and "simplicity" has created a culture of complacency—complacency in both the testing of the actual usage habits and the overuse of VLLs in applications where more thoughtful and careful preplanning can avoid their use altogether.

Enhance the sustainability of your fall protection program by becoming a participant in advancing our knowledge, understanding, and utilization of this potentially invaluable tool.

[6] Occupational Safety and Health Administration (OSHA): Federal Registers. May 24, 2010. Proposed Rules. Federal Register No. 75:28861–29153, *Walking-Working Surfaces and Personal Protective Equipment (Fall Protection Systems); Proposed Rule* (retrieved December 1, 2010) (http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=FEDERAL_REGISTER&p_id=21518).