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Perspectives on New Fall Protection Standards

**PS:** Describe your role with the Z359.4 and Z359.13 subcommittees.

**Randall:** I have two separate roles within Z359—chair of the Z359.13 subcommittee and chair of the Z359 Accredited Standards Committee (ASC). As Z359.13 subcommittee chair, my role is to develop the standard, work with subcommittee members and present the standard to the full committee. I have the same responsibility with the Z359.1, Z359.2 and Z359.7 subcommittees.

As Z359 ASC chair, I manage the full committee. In this role, I move all standards forward, monitor and accept standards put forward by subcommittee chairs and offer direction and assistance when needed.

**Tom:** I have been a member of the Z359 ASC since its inception in the 1980s and continue to be actively involved today. I am chair of the Z359.4, Z358.14 and Z359.16 subcommittees. My involvement with the Z359.13 standard has been through participation at the full committee level in reviewing and commenting on the standard as it develops.

**PS:** Version 3 of the Z359 Fall Protection Code includes two new standards: Safety Requirements for Assisted-Rescue and Self-Rescue Systems, Subsystems and Components (Z359.4-2013) and Safety Requirements for Lanyards and Energy Absorbers for Personal Fall Arrest Systems (Z359.13-2013). How do these two standards complement the other standards in the code?

**Randall:** The code intends for most major equipment components or items to have their own individual number. The design and testing requirements within each standard work in concert with the code and other standards. Although the content within Z359.4 and Z359.13 are specific to rescue systems and energy-absorbing lanyards, they have a similar structure, testing methods and general labeling requirements to other standards.

Z359.13 has a dramatic effect on the code. It is a technical standard that addresses several topics common to the other standards. Z359.13 is the first standard to require a 282-lb test weight to more accurately represent a 310-lb tooled, clothed worker. It is the first to include an averaging method of calculating arresting force, and it is also the first to require that energy absorbers and lanyards be tested through an ISO-accredited 17025 testing lab.

**Tom:** I refer to the Z359.4 standard as one of the horizontal standards within the code. It addresses a collection of equipment, some of which have individual component standards that collectively could be used for assisted-rescue or self-rescue. This includes lanyards like those found in the Z359.13 standard, for example. A simple rescue system might involve a full-body harness, a supporting structure such as a davit and a hoist, all assembled to effect a rescue.

Z359.4’s requirements are specific to the rescue aspects of these components and use considerations. Some equipment requirements for rescue are starting to migrate into the individual equipment standards as they are developed. One example is the Z359.14 standard which now includes those devices with a retrieval function. Another might be the descender standard once it is completed. However, I expect that Z359.4 will remain relevant as a home for the unique rescue considerations of this gear and for standardization of rescue equipment that does not warrant an individual standard.

**PS:** How have SH&E professionals responded to the two new standards since the release of the latest version of the code? Has the committee heard any real-life success stories of the standards in action?

**Randall:** A great example would be the Z359.13 standard and its testing requirements. Z359.13 includes a reference to Qualification and Verification Testing of Fall Protection Products (ANSI/ASSE Z359.7-2011), which requires that product manufacturers use an ISO-accredited 17025 testing lab to conduct qualification and verification testing of products. Several energy absorbers and energy-absorbing lanyards were produced and marketed as meeting the standard but were in truth substandard items. Product failure occurred due to incorrect test methods and practices or the absence of testing. Z359.13 represents the first standard to require testing in an ISO-accredited lab.

We are witnessing an increased awareness to use Z359 equipment as more organizations recognize the value in
specifying and using Z359 equipment. The Z359 code represents the largest collection of standards dedicated to fall protection and rescue equipment and is gaining more recognition worldwide.

**Tom:** As a manufacturer, I know many customers specifically request equipment that is Z359-compliant, including Z359.4 and Z359.13. For example, in the wind power industry, many of the larger players are global in nature and they require equipment to comply with all regional standards and regulations. The Z359 standards are often cited in their equipment specification documents as the benchmark for U.S. operations.

**PS: What challenges did the subcommittees face during development of these standards? How were they handled?**

**Randall:** The Z359.13 subcommittee faced several technical challenges during development. One was to develop more accurate testing and to address the 220-lb test weight and the generally accepted 1.4 conversion factor that did not accurately represent a 310-lb worker.

Another challenge was the method used to calculate the arresting forces of energy absorbers. Prior to Z359.13, decisions were made on energy absorbers based on a single data point during test results. Interpreting an energy absorber’s performance based on one data point created issues and, in a way, was a disservice to the user. Products needed to be manufactured with a lower capacity to pass the ANSI tests, increasing the overall fall distance.

New products posed another challenge. Prior to Z359.13, no standards existed for lanyards with two lanyard legs or energy absorbers designed for 12-ft free falls. To address this, subcommittee members conducted tests on each issue, reported findings to all members and created the standard based on the findings.

**Tom:** The Z359.4 subcommittee needed to develop a standard that encompassed a wide range of equipment. Another issue was limiting the types of equipment to those that the average worker could deploy with limited training and rescue experience. More training-intensive and skill-oriented equipment needed to be set aside. Finally, we needed to develop terminology that could communicate the standard’s requirements clearly in different rescue situations. These challenges were overcome simply by the hard work of the subcommittee members along with the support and guidance of the full committee. We were also able to lean on some existing international standards that provided a starting point for some of our work.

**PS: How did the subcommittees develop the extensive qualification testing guidelines included in the standards? Did they conduct their own tests?**

**Randall:** Historical testing from Z359.1 was used as a foundation for testing developed in Z359.13. Several new tests needed to be developed to include y-lanyards, 12-ft free-fall energy absorbers and wraparound lanyards (lanyards that can be wrapped around an anchorage and anchored back onto itself). Mature test protocols for static and dynamic performance tests already existed, but they needed to be changed to accommodate a heavier test weight and a new force averaging method. Several new tests were developed to address y-lanyards and challenges with both lanyard legs connected to one anchorage (dual connection) and when one lanyard leg is stored on the harness (hip-loading).

Z359.13 also included environmental conditioning tests where the equipment is put into hot, cold and wet environments before qualification testing. Subcommittee members developed guidelines, divided the work and volunteered their organizations’ time, money and equipment. The Z359 ASC relies heavily on its members’ volunteerism to develop these guidelines.

As an ISO-accredited 17025 testing lab, Gravitec Systems conducted several test and research studies while developing Z359.13. Prior to Z359.7, no minimal guidelines existed on how fall protection equipment was tested. There were no requirements for the number of tests, frequency of tests, reporting of results or qualifying the ability of the laboratory or agency conducting the testing. Z359.7 increases consumer confidence in all ANSI products by requiring that fall protection products be tested in an ISO-accredited testing lab.

**Tom:** In the case of Z359.4, much of the testing was patterned after tests found in international standards for similar equipment. With this approach, we knew we had achievable performance benchmarks. These procedures were altered where necessary to align with the Z359 norms for static strength or dynamic performance of the base device. In general, a 10:1 factor of safety based on the worker capacity limit of 310 lb was used as the performance target. Since we used established benchmarks, equipment suppliers did not need to evaluate much new testing. This resulted in a fairly smooth transition to an approved standard once presented to the full committee.

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PS: Z359.4 calls for an established rescue plan. What elements should this plan contain? How should it be written for it to be well understood and effective?

Randall: This can be a challenging question to answer because every location will have different rescue needs. Height, location, available staff, history of incidents, equipment location and local emergency services can all affect a local rescue plan. I recommend conducting a survey of the areas where workers may be suspended in a fall arrest system or at height. Based on this survey, a company can develop a fully functioning rescue plan that would identify rescuers’ path of travel, protection methods, rescue methods, anchorages and safe areas. Common themes will be realized from the survey where training and equipment needs can be developed. Z359.2 includes direction for conducting a survey as well as rescue planning.

Tom: The standard provides some high-level guidance about what a rescue plan should consider. Key elements include methods of rescue, rescue personnel availability, type of equipment available for rescue, effective means to summon rescue personnel, drilling of rescue personnel in rescue and evacuation procedures, and rescue safety as the plan’s first priority. Additional guidance can be found elsewhere in the standard, such as having a competent person involved in preparing the rescue plan.

The competent person who has knowledge of the workplace and the employee audience need to determine the best approach for communicating the rescue plan and for measuring its effectiveness.

PS: Z359.13 provides detailed guidelines for equipment inspection, maintenance and storage. What common use and care mistakes do users of personal energy absorbers and energy-absorbing lanyards make?

Randall: Two common mistakes are the capacity of the equipment and compatibility with the anchorage. Capacity is how much energy the lanyard can safely dissipate. Users and supervisors alike need to look more closely at how the equipment is rigged to ensure that the energy absorber will function as intended.

When using a 6-ft free-fall energy-absorbing lanyard, it has a capacity of safely arresting a 310-lb tooled, clothed worker freefalling 6 ft. Any situation in which the weight or fall distance is greater; there is a risk of bottoming out the energy absorber and exposing the worker to higher impact forces. Although it may be difficult or infeasible in many situations to have a perfect anchorage, we often witness workers using a 6-ft free-fall energy absorber in situations where the free fall is greater than 6 ft.

Compatibility with the anchorage is another common issue. Snap hooks and carabiners used on the ends of lanyards have become larger over the years. Larger hooks have larger gates, increasing the opportunities for the gates of the hooks to be transversely loaded or to contact surrounding structure.

Z359.13 lanyards are manufactured with connectors meeting Z359.12, which means all connectors have gates rated to 3,600 lb. Although the gate has a 3,600-lb rating, users must be cautious with how the hook interacts with the anchorage and surrounding structure. There is a general misconception that once a worker is wearing the equipment and is tied-off, s/he is safe. We must educate workers to be more aware of hardware incompatibility.

Tom: Common mistakes relate to rigging of the system. Selecting a proper anchorage location relative to the work at hand can be challenging in particular because many things must be considered when making the rigging decision. What possible free fall might I have? What swing fall hazards exist in the area should I fall? How much fall clearance is available? Is the anchorage strong enough? Is my connector compatible? Does my energy absorber have sufficient capacity? All of these questions must be considered and evaluated every time a user selects an anchorage location and moves around the job site.

Lanyards are exposed to some of the most severe use conditions of any fall protection equipment. They often drag or abrade against objects as workers perform their tasks, and they also must interface with anchorages that might be abusive to the lanyard material. Lanyards are commonly exposed to harsh materials and other environmental factors around job sites, such as chemicals, paint, dirt and oil, and weld spatter, which can shorten their life considerably. Not keeping lanyards clean is probably the most common downfall of many users. Soiling causes abrasion and wear, and makes the item difficult to inspect. Another common mistake is storing the equipment wet. This accelerates corrosion of the metal components and can deteriorate labels and markings.

PS: Why did the Z359 ASC choose to add A10.32-2012, Fall Protection Systems for Construction

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and Demolition Operations, and Z490.1-2009, Criteria for Accepted Practices in SH&E Training, to Version 3 of the code?

Randall: Since A10.32 referred to Z359, it was a logical step to supply the A10.32 standard with the code. Up to this point, the construction industry was specifically excluded from Z359 standards because of A10.32’s scope. To reduce duplication of efforts and maintain consistency, it was beneficial for A10.32 to use equipment designed and tested according to Z359 and for the code to remove construction industry exclusions.

Z490 was included in the code for many of the same reasons. Educating and training workers who use fall protection equipment are keys to the success of an organization’s fall protection program. Z359.2 describes minimum requirements for training and developing an organization’s fall protection program. Z359.2 is specific to fall protection and rescue training, but it did not include fundamental training topics such as needs assessments, training environment, evaluation methods and instruction methods. The inclusion of Z490.1 within the code supplements the training requirements found in Z359.2.

Tom: A10.32 has long been a reference for the construction and demolition trades for all active fall protection system guidelines. Since the Z359 code recently removed the exclusion of construction and demolition from its scope, it makes sense to include this document as a ready reference. The A10.32 standard includes perspectives on fall protection unique to the construction and demolition trades such as field welding of anchorages that supplement the requirements found in the Z359 code.

Proper training is a fundamental building block of every successful fall protection program. Employees at each level of involvement in the program need well-developed and administered training to do their jobs effectively and safely. Including Z490.1 in the code helps emphasize and reinforce the importance of training. It also may be the only exposure code-users have to training methodologies recognized by a national standard.

PS: What is the status of other Z359 standards projects in development?

Randall: Z359 subcommittees are continually working on their respective standards. Even standards already written have subcommittees that meet regularly to address upcoming issues and prepare for revisions.

Three standards will come out in the near future—Z359.11, Z359.15 and Z359.18. These standards address safety requirements for full body harnesses, fall arresters, lifelines and anchorage connectors. There is a specific push to develop these three standards so the Z359 ASC can address Z359.1. The content in Z359.1 has been relatively untouched while individually numbered standards have been developed. Upon completion of the three mentioned standards, all of Z359.1’s content will be added in individually numbered standards, and Z359.1 can be modified. This will end the confusion and duplication of content found within the Z359 Fall Protection Code. Z359.1 will remain part of the code and will likely be an introductory document to the other numbered standards.

Tom: A long list of development activity is taking place within the Z359 ASC. Roughly 15 active subcommittees are working on draft documents that are in various stages of the process. Of the standards in development, the chair has given priority to those vertical equipment standards that will ultimately allow the committee to repurpose Z359.1. Replacing it will create a complete family of comprehensive individual equipment standards and a series of standards that address broader concepts within fall protection, such as rescue. Full body harnesses, anchorage connectors and fall arresters are the three key equipment standards under development that, once finished, will move this process forward. The committee agreed to retain the Z359.1 standard in a new yet-to-be-determined format due to the high level of awareness this standard has achieved over the years as the benchmark standard for fall protection.

PS: How do you anticipate Z359.4 and Z359.13 will influence fall protection practices and products long term?

Randall: Like all Z359 standards, I anticipate manufacturers and organizations will use these two standards to improve the safety of workers at height. Research and development conducted during the writing of Z359.13 regarding test weights, conversion factors, force averaging and new products are having a dramatic effect on other standards. Ideally, every time a subcommittee meets to discuss the standard, it reviews industry best practices, new technology, better tests and more stringent tests while allowing equipment manufacturers to be creative in developing new products. Long term, I hope that governing bodies recognize these two standards as the industry-best for rescue equipment and energy-absorbing lanyards.
**Tom:** Long term, we hope these two standards and the code will form the basis of improved regulatory guidelines for fall protection. Ideally, OSHA will recognize the Z359 code as the state-of-the-art for fall protection requirements and will incorporate these guidelines as compulsory. Until that time, the Z359 ASC’s work will continue to focus on standardizing best practices in the fall protection field and on raising the bar for safety.

**Randall Wingfield** is founder, president and CEO of Gravitec Systems Inc., a firm that offers fall protection education and rescue training, engineering systems design and ISO testing. He has been involved in the continuing development of national and international standards for fall protection equipment and training for the past 30 years. Wingfield is a member of ASSE’s Puget Sound Chapter.

**Tom Wolner** is vice president of engineering for Capital Safety, a supplier of fall protection, rescue and rope access equipment under the DBI Sala, Protecta and Uniline brands. He is actively involved in the development of industry standards and regulations in the U.S. and internationally, and has received multiple patents for innovations in fall protection equipment design. He is a former board member of the International Society for Fall Protection and a recipient of ISEA’s Award for Excellence in Fall Protection.