

Hooked on Safety

A Review of Changes to ANSI Z359.1-1992(R1999) With Emphasis on Section 3.2.1.4

I. Introduction

As safety equipment manufacturers adapt to the changes contained in ANSI Z359.1-2007, specifically, the revision of gate hook strength requirements for snap hooks and carabiners, myriad questions have risen regarding equipment currently in use.¹ This review of the changes to ANSI Z359.1 intends to diminish concerns and address the benefits of increasing the gate hook strength of locking connectors.

II. History of the standard

ANSI Z359.1 was originally published in 1992 to address technological advances in fall arrest equipment that occurred in the 1970s and 1980s. Fall protection equipment and programs advanced rapidly, outpacing preexisting national standards and government regulations. Several industry specific standards did exist, but most of them were considered outdated. To that end, the United States Technical Advisory Group (USTAG), representing national fall protection issues to the International Organization for Standardization (ISO), formed a committee to address the lack of fall protection standards, as recommended by the American National Standards Institute's Safety and Health Standards Board. The committee drafted and voted on the Z359.1 standard and the American Society of Safety Engineers became the secretariat. The standard was published as the first in a series of fall protection standards. ANSI Z359.1 applies only to fall arrest equipment in occupational and non-occupational activities, with the exception of the construction industry, which has its own standards.²

ANSI Z359.1, as originally written and revised in 1999 (the revision consisted only of editorial alterations)³, consists of eight sections, plus appendices and figures. The eight sections included:⁴

1. Scope, Purpose, Application, Exceptions and Interpretations
2. Definitions
3. Requirements
4. Qualification Testing
5. Marking and Instructions
6. User Inspection, Maintenance and Storage of Equipment
7. Equipment, Selection, Rigging, Use and Training
8. References

¹ See *Safety Requirements for Personal Fall Arrest Systems, Subsystems and Components*, American National Standard. American Society of Safety Engineers, September, 2007. Page 11-12.

² See *Safety Requirements for Personal Fall Arrest System, Subsystems and Components*, American National Standard. American Society of Safety Engineers, 1999 Page 3-4.

³ See *Safety Requirements for Personal Fall Arrest System, Subsystems and Components*, American National Standard. American Society of Safety Engineers, 1999. Page 3.

⁴ See *Safety Requirements for Personal Fall Arrest System, Subsystems and Components*, American National Standard. American Society of Safety Engineers, 1999. Page 6.

This standard addresses fall arrest equipment including harnesses, lifelines, lanyards, energy absorbers and anchorage connectors and elements of the equipment including rope, straps, thread, thimbles and connectors.

The section dealing with the strength of gate hooks, section 3.2.1.4, stated:⁵

Snap hooks and carabiners shall be self-closing and self-locking and shall be capable of being opened only by at least two consecutive deliberate actions. When tested in accordance with 4.3.1.1.1, snap hooks and carabiners shall be capable of withstanding a 5,000 pound (22.2 kN) tensile load without breaking or distortion sufficient to release the gate. When tested in accordance with 4.3.1.1.2, the gate of a snap hook or carabiner shall be capable of withstanding a minimum load of 220 pounds (1 kN) without the gate separating from the nose of the snap hook or carabiner body by more than 0.125 inches (3 mm) [SIC]. When tested in accordance with 4.3.1.1.3 the gate of the snap hook or carabiner shall be capable of withstanding a minimum side load of 350 pounds (1.55 kN) applied to a point midway between the nose and gate hinge without breaking, permanent deformation greater than 0.125 inches (3.1 mm), or separating from the nose of the snap hook or carabiner body by more than 0.125 inches (3 mm) [SIC].⁶

III. Changes to ANSI Z359.1 Section 3.2.1.4

The changes to the section of ANSI Z359.1 dealing with gate hook strength are detailed as follows:⁷

Snap hooks and carabiners shall be self-closing and self-locking and shall be capable of being opened only by at least two consecutive deliberate actions. When tested in accordance with 4.3.1.1.1, snap hooks and carabiners shall be capable of withstanding a 5,000 pound (22.2kN) tensile load without breaking or distortion sufficient to release the gate. When tested in accordance with 4.3.1.1.2, the gate of a snap hook or carabiner shall be capable of withstanding a minimum load of 3,600 pounds (16kN) without the gate separating from the nose of the snap hook or carabiner body by more than 0.125 inches (3.1mm). When tested in accordance with 4.3.1.1.3 the gate of the snap hook or carabiner shall be capable of withstanding a minimum side load of 3,600 pounds (16kN) applied to a point midway between the nose and gate hinge without breaking, permanent deformation greater than 0.125 inches (3.1mm), or separating from the nose of the snap hook or carabiner body by more than 0.125 inches (3.1mm). When tested in accordance with 4.3.1.1.4 the gate of the snap hook or carabiner shall be capable of withstanding a minimum minor axis load of 3,600 pounds (16kN) applied to a point midway between the nose and gate hinge without breaking or distortion sufficient to release the gate. Testing in the minor axis is not required for carabiners or snap hooks which are designed with a permanent, captive eye.

The testing referred to in section 4.3.1.1.4 is another change to ANSI Z359.1. This test refers to minor axis testing of snap hook and carabiner gates. The test is detailed as follows:⁸

Position the snap hook or carabiner in the clamping fixture such that the inside face of the gate is generally parallel to the test bed and the gate's motion is perpendicular to the test bed (See Figure 4.3.1.1.4). Apply the test load at a constant rate (speed of three inches/minute) until the required test load of 3,600 pounds is reached.

⁵ See *Safety Requirements for Personal Fall Arrest System, Subsystems and Components*, American National Standard. American Society of Safety Engineers, 1999. Page 24.

⁶ The testing referred to in sections 4.3.1.1.1, 4.3.1.1.2 and 4.3.1.1.3 lays out procedures for testing tensile, gate face and side loads of snap hooks and carabiners. Testing procedures can be reviewed in *Safety Requirements for Personal Fall Arrest System, Subsystems and Components*, American National Standard. American Society of Safety Engineers, 1999. Page 43-44.

⁷ See *Safety Requirements for Personal Fall Arrest Systems, Subsystems and Components*, American National Standard. American Society of Safety Engineers, September, 2007. Page 11-12.

⁸ See *Safety Requirements for Personal Fall Arrest Systems, Subsystems and Components*, American National Standard. American Society of Safety Engineers, September, 2007. Page 37-38.

To summarize, the changes have increased the load that a gate face must be able to withstand from 220 pounds to 3,600 pounds, the side of the gate must be able to withstand 3,600 pounds, increased from 350 pounds, and the minor axis of a snap hook or carabiner must be able to withstand 3,600 pounds (except for those with captive eyes), which is new to the Z359.1 standard. The tensile load that the snap hook or carabiner must be able to withstand will remain at 5,000 pounds.

Snap hooks and carabiners meeting the new standard will be marked as follows to help equipment users distinguish them from previous generations of connectors in the field:⁹

- Year of manufacture
- Manufacturer's identification
- Part number
- Load rating for the major axis of the connector stamped or otherwise permanently marked on the device
- Load rating for gate stamped or otherwise permanently marked on the gate mechanism; Markings for connectors shall be sufficient to provide traceability
- For connectors that are non-integral, include the standard number, "Z359.1(07)"

IV. Explanation of Changes

Tom Wolner, Vice President of Engineering with Capital Safety, explains that these changes were made to make fall arrest equipment a better product. "The revisions will make fall arrest equipment stronger, which must be differentiated from describing it as safer. Equipment that meets the standard in its previous form will protect workers in the event of a fall, provided that the equipment is used correctly. Accidents happen due to misuse, incompatible elements and damaged equipment, not because elements of the equipment are not strong enough." The most common equipment failure occurs when a worker improperly ties off to a non D-ring connection. The higher strength requirements for locking connectors will prevent forced rollout.

Another reason for the changes, as the new Z359.1 standard states, is as follows:¹⁰

The need for this standards activity grew out of the continuing development of a series of fall protection-related standards. The focus is to tie the elements of those standards together and provide the tools with which employers may develop the programs that incorporate those elements.

Furthermore, the industry is always making strides in technology. Experiences lead to research, which leads to improvements in equipment designs.

V. Enacting the new ANSI Z359.1

Manufacturers of fall protection equipment completed a significant amount of work to be ready for the effective date of November 24, 2007. These preparations included changing the labels of equipment, updating instructions for use and completing testing of the equipment to comply with the changes. The changes to the hook represent the most significant product changes, and most products are now available with the new hooks.

⁹ See *Safety Requirements for Personal Fall Arrest Systems, Subsystems and Components*, American National Standard. American Society of Safety Engineers, September, 2007. Page 50-51.

¹⁰ See *Safety Requirements for Personal Fall Arrest Systems, Subsystems and Components*, American National Standard. American Society of Safety Engineers, September, 2007. Page 4.

Much of the equipment in common industrial use, according to Wolner, is already rated ahead of the previous version (1999) of the standard. Elements of the equipment such as the snap hooks and carabiners on lanyards go far beyond the minimum load requirements. Nevertheless, employers utilizing the equipment should develop plans for the maintenance and overhaul of equipment currently in use.

Capital Safety will offer equipment meeting both versions of the standard until the market has fully adopted the new version. At that point, only equipment with the hooks rated to 3,600 pounds will be available. Retrofitting old equipment with new hooks is not an option due to the assembly of the products.

In terms of budgeting for the new standard, purchasers may notice a slight increase in the price of fall protection equipment. Larger, stronger hooks are more expensive than previous generations of hooks.

Employers will need to prepare end-users of the equipment for the change. The strength and size difference of the new hooks will contribute to a slight increase in weight, however the difference will be minimal. Operation of the snap hooks and carabiners and the equipment they are incorporated in will remain the same. Equipment will remain ergonomically friendly and end-users should notice no difference in comfort.

VI. Conclusion

Manufacturers, employers and end-users alike will be affected by the changes to ANSI Z359.1, notably by the revisions to gate hook strength requirements for snap hooks and carabiners. While questions and concerns are certain to arise, proper education and training on the requirements of the standard will resolve these matters. The updated standard will make fall arrest equipment stronger, which in turn will move the industry forward with continued emphasis on safety.

As the only manufacturer dedicated solely to fall protection equipment, Capital Safety invests heavily in developing products that meet and exceed compliance standards. The company works tirelessly to ensure the safety of workers exposed to fall hazards by leading the industry in equipment innovations.