



ANSI OVERVIEW



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UNDERSTANDING ANSI & ITS ROLE IN WORKPLACE SAFETY

When it comes to workplace safety, many people are familiar with OSHA, the Occupational Safety and Health Administration, which establishes legally enforceable regulations to protect workers. However, fewer people recognize the equally critical role played by the American National Standards Institute (ANSI). ANSI isn't a government agency—it's a private, non-profit organization—but its impact on safety, especially in industries involving fall protection, is profound.

WHAT IS ANSI?

Founded in 1918, ANSI coordinates the creation and adoption of voluntary consensus standards in the United States. These standards cover a wide range of industries, from technology and construction to healthcare and manufacturing. While ANSI doesn't write the standards themselves, it accredits committees of subject matter experts, manufacturers, and other stakeholders who collaboratively develop them. ANSI serves as the overseer, ensuring these standards meet rigorous procedural requirements and reflect broad consensus.

WHY IS ANSI IMPORTANT?

ANSI standards provide detailed, best-practice guidance for designing systems, developing safety programs, and manufacturing equipment. In the realm of fall protection, ANSI's Z359 standards set benchmarks for equipment like harnesses, lanyards, and anchors, as well as for training and managed fall protection programs. These standards go beyond the minimum requirements set by OSHA, offering more specific and advanced recommendations for creating safer workplaces. Adhering to ANSI standards can reduce workplace injuries, improve employee confidence, and demonstrate an employer's commitment to safety excellence.

HOW DOES ANSI DIFFER FROM OSHA?

A key distinction between ANSI and OSHA is their enforceability. OSHA regulations are federal law, and failing to comply can result in fines, penalties, or legal action. ANSI standards, on the other hand, are voluntary. They provide a roadmap for achieving safety excellence but aren't legally binding unless incorporated by reference into OSHA regulations or other local codes. Despite their voluntary nature, ANSI standards are often viewed as the gold standard and are frequently used in legal cases to determine whether an employer's safety measures were reasonable.

HOW IS ANSI GOVERNED?

ANSI operates under a set of governance principles designed to ensure transparency, inclusivity, and impartiality. Standards are developed by accredited committees comprising experts from diverse backgrounds, including industry, labor organizations, academia, and government. This collaborative process ensures that ANSI standards reflect the collective wisdom of the field while remaining practical and applicable.

THE ROLE OF ANSI Z359 IN FALL PROTECTION

One of ANSI's most significant contributions to workplace safety is the Z359 Fall Protection Code. This series of standards provides comprehensive guidelines for preventing falls and ensuring effective rescue measures when falls occur. It covers everything from the design of personal protective equipment (PPE) to the responsibilities of employers in creating and maintaining fall protection programs. For industries where working at height is common, such as construction, manufacturing, and energy, Z359 serves as an indispensable resource.

WHY SHOULD EMPLOYERS & SAFETY PROFESSIONALS CARE?

While compliance with OSHA is mandatory, aligning with ANSI standards demonstrates a proactive approach to workplace safety. It not only helps prevent accidents but also fosters a culture of safety that can improve productivity, morale, and overall business performance. For safety professionals, understanding and implementing ANSI standards like Z359 is a hallmark of expertise and leadership in the field.

In summary, ANSI is a cornerstone of safety innovation, offering tools and standards that go beyond compliance to create truly safe workplaces. By understanding its purpose, governance, and impact, employers and safety professionals can better leverage ANSI standards to protect their workforce and enhance their safety programs.

KEY ELEMENTS

OF THE STANDARD

ROLES AND RESPONSIBILITIES

The ANSI Z359.2 standard defines specific roles within the fall protection program, assigning duties to ensure accountability and effectiveness. Key positions include:

- **EMPLOYERS:** Responsible for endorsing and supporting the program at a corporate level.
- **PROGRAM ADMINISTRATORS:** Oversee program implementation and maintenance.
- **QUALIFIED PERSONS:** Design and evaluate fall protection systems.
- **COMPETENT PERSONS:** Conduct hazard assessments and supervise on-site safety.
- **AUTHORIZED PERSONS:** Perform tasks while exposed to fall hazards.
- **RESCUERS:** Handle emergency rescue operations, categorized as Competent or Authorized.
- **TRAINERS:** Provide education tailored to each role, ensuring competency and compliance.

TRAINING STANDARDS & EVALUATIONS

Training is a central tenet of the ANSI Z359.2 standard, reflecting the collective expertise of the Z359 committee. The standard integrates ANSI Z490.1, which establishes best practices for safety training, to enhance education and improve outcomes.

Training must address:

- Hazard recognition and risk mitigation.
- Proper use, inspection, and maintenance of fall protection equipment.
- Rescue techniques and emergency response.

Regular evaluations are required to ensure training effectiveness and to adapt programs to emerging risks or technologies.

FALL PROTECTION PROCEDURES & HAZARD CONTROL

The standard emphasizes the preparation of a Fall Hazard Survey Report, conducted by Qualified or Competent Persons. This report identifies workplace fall risks and outlines controls using the hierarchy of controls, ranked as follows:

1. Elimination of hazards.
2. Passive systems (e.g., guardrails).
3. Fall restraint systems.
4. Fall arrest systems.

DESIGNING FOR SAFETY IN NEW FACILITIES

By incorporating fall protection requirements during the design phase of new facilities, architects and engineers can address hazards before they arise. This proactive approach minimizes costs and ensures compliance with safety standards from the outset.

ANCHOR SYSTEMS

The ANSI Z359.2 standard provides detailed requirements for anchor systems, vital to the integrity of fall protection systems. Anchors are classified as:

Training must address:

- **Certified Anchors:** Verified by testing or analysis under the supervision of a Qualified Person, supported by documentation.
- **Non-Certified Anchors:** Deemed adequate by a Competent Person, with limitations on free fall distances and arrest forces.

Certified anchors are preferred due to their rigorously documented reliability.

ROPE ACCESS & RESCUE OPERATIONS

Rope access techniques are gaining prominence for tasks involving vertical work suspension. ANSI Z359.2 establishes foundational principles for rope access, including:

- The use of dual-rope systems for redundancy.
- Team-based operations to ensure safety and efficiency.

INCIDENT INVESTIGATIONS & PROGRAM EVALUATION

To ensure continuous improvement, the ANSI Z359.2 standard mandates:

- **Incident Investigations:** Comprehensive analysis and documentation of fall-related incidents to identify root causes and prevent recurrence.
- **Program Evaluations:** Regular reviews to assess the program's effectiveness, address deficiencies, and reinforce its strengths.

Employers are encouraged to use evaluation findings to refine training, equipment, and procedures, fostering a culture of safety and compliance.

CONCLUSION

The ANSI Z359.2 standard is a vital resource for employers committed to worker safety. By addressing every aspect of fall protection—from hazard assessment and training to equipment use and rescue planning—it provides a roadmap for creating robust, effective programs. Compliance with this standard not only protects workers but also demonstrates an employer's dedication to safety excellence and regulatory adherence.

UNDERSTANDING ANSI Z359.3:

WORK POSITIONING & TRAVEL RESTRAINT SYSTEMS

The ANSI Z359.3 standard sets critical guidelines for the design, testing, and application of work positioning and travel restraint systems. These systems are essential tools for worker safety, particularly in environments where hands-free tasks or movement restriction is required to mitigate fall risks. Below, we explore the key components and requirements of this standard.

DEFINING WORK POSITIONING & TRAVEL RESTRAINT

WORK POSITIONING SYSTEMS

Work positioning systems are designed to support a worker on a vertical surface, such as a wall or pole, allowing them to perform tasks without the need to hold onto the structure for stability.

- **PURPOSE:** These systems allow workers to perform hands-free tasks while maintaining stability.
- **FALL PROTECTION REQUIREMENT:** When fall hazards exist, work positioning systems must always be supplemented with independent personal fall arrest systems to ensure redundancy and safety.

TRAVEL RESTRAINT SYSTEMS

Travel restraint systems limit a worker's movement, preventing them from entering zones where fall hazards exist.

- **PURPOSE:** Unlike work positioning, travel restraint systems do not support the worker's weight but act as a boundary to prevent access to fall hazard areas.
- **APPLICABLE SURFACES:** These systems are specifically designed for use on walking or working surfaces with slopes of up to **18.4 degrees**.

KEY COMPONENTS OF WORK POSITIONING & TRAVEL RESTRAINT SYSTEMS

FULL-BODY HARNESSES

Full-body harnesses are a cornerstone of any fall protection system, including work positioning and travel restraint systems. The ANSI Z359.3 standard outlines rigorous requirements for these harnesses to ensure worker safety:

1. **COMPLIANCE WITH Z359.11:** Harnesses must meet the requirements for fall arrest systems as defined in ANSI Z359.11.
2. **DYNAMIC STRENGTH TESTING:** Harness attachment elements, typically D-rings, are subjected to a dynamic test. This involves:
 - A 3.3-foot free fall.
 - A test weight of 282 pounds.
 - Testing ensures the durability and reliability of harness components under work positioning and travel restraint conditions.

LANYARDS FOR WORK POSITIONING & TRAVEL RESTRAINT

Lanyards are critical connecting elements in these systems. ANSI Z359.3 specifies stringent requirements for their design and testing:

- **STATIC LOAD CAPACITY:** Lanyards must withstand a static load of 5,000 pounds of force without failure.
- **PURPOSE:** This ensures that lanyards maintain their integrity during use, providing a reliable connection between the worker and the anchorage system.

INTEGRATING WORK POSITIONING & TRAVEL RESTRAINT SYSTEMS

To maximize safety, these systems are often integrated with other fall protection measures:

- **WORK POSITIONING SYSTEMS:** Should always be paired with an independent fall arrest system to safeguard against falls if the primary system fails or the worker's positioning changes unexpectedly.
- **TRAVEL RESTRAINT SYSTEMS:** While these systems do not need to arrest falls, they must be meticulously designed and tested to ensure they effectively prevent workers from entering fall hazard zones.

APPLICATIONS & BEST PRACTICES

To maximize safety, these systems are often integrated with other fall protection measures:

- **VERTICAL WORK:** Work positioning systems are commonly used in industries such as construction, telecommunications, and utilities, where workers need to perform tasks on vertical structures like poles or towers.
- **FALL HAZARD ZONES:** Travel restraint systems are widely applied in environments where workers are exposed to unprotected edges, such as rooftops or elevated platforms, but do not need full fall arrest systems due to the absence of free fall risks.

Employers must ensure that all components—harnesses, lanyards, and anchorage points—are correctly selected, installed, and inspected according to ANSI Z359.3 to maintain compliance and worker safety.

CONCLUSION

The ANSI Z359.3 standard provides comprehensive guidance on work positioning and travel restraint systems, emphasizing the importance of robust design and rigorous testing. By adhering to these guidelines, employers can create safer work environments, ensuring that workers are protected when performing hands-free tasks or when movement needs to be restricted to prevent access to fall hazards. This standard underscores the critical role of proactive safety measures in minimizing risks and enhancing worker confidence in high-risk environments.



UNDERSTANDING ANSI Z359.4:

STANDARDS FOR RESCUE & EVACUATION SYSTEMS

The ANSI Z359.4 standard sets forth comprehensive requirements for rescue and evacuation systems used in pre-planned scenarios. These guidelines cover every aspect of rescue equipment, from design and performance to training and maintenance, ensuring that rescue operations are both effective and safe for all parties involved.

SCOPE OF EQUIPMENT COVERED

ANSI Z359.4 applies to a variety of specialized equipment used in rescue and evacuation, including:

- 1. CONNECTORS:** Essential for linking various components of the system securely.
- 2. ROPE TACKLE BLOCKS:** Used for creating mechanical advantage during lifting or lowering.
- 3. ANCHORAGE CONNECTORS:** Provide secure attachment points for rescue systems.
- 4. SELF-RETRACTING LANYARDS WITH RESCUE CAPABILITY:** Dual-purpose lanyards designed to arrest a fall and facilitate rescue.
- 5. HARNESSES:** Serve as the primary means of worker support during rescue.
- 6. WINCHES/HOISTS:** Used to lift or lower individuals safely in rescue scenarios.
- 7. DESCENT CONTROL DEVICES:** Allow controlled descent during evacuation.
- 8. LANYARDS:** Provide critical connections within the system, ensuring safety and reliability.

PURPOSE & APPLICATION

The primary purpose of ANSI Z359.4 is to provide detailed guidelines for the use of rescue systems in pre-planned scenarios involving one or two persons where fall hazards are present. This standard is distinct from other rescue standards and is tailored for specific applications:

- **APPLICABILITY:** Pre-planned rescues in work environments where fall protection is essential.
- **EXCLUSIONS:** It does not apply to:
 - Construction work.
 - Sports or recreational activities.
 - Certified rope access rescue techniques.
 - Situations covered by other national standards, such as NFPA 1983 for emergency rescue equipment.

Competent Persons bear the responsibility of determining whether equipment specified in this standard is suitable for use in hazardous atmospheres. While it doesn't restrict professional rescue teams, such as fire departments, from using this equipment, those scenarios often fall under different governing standards.



SYSTEM REQUIREMENTS

Rescue systems designed and used under ANSI Z359.4 must meet stringent requirements to ensure they are capable of handling the demands of pre-planned rescue operations:

CAPACITY REQUIREMENTS:

- **ONE-PERSON RESCUE SYSTEM:** Must accommodate individuals weighing between 130 and 310 pounds.
- **TWO-PERSON RESCUE SYSTEM:** Must support a total load between 160 and 600 pounds, accounting for both the rescuer and the person being rescued.

CONNECTOR REQUIREMENTS:

- All connectors used in rescue systems must comply with the strength and performance specifications outlined in **ANSI Z359.12**. This ensures uniformity and reliability across all components.

DESIGN & PERFORMANCE STANDARDS

ANSI Z359.4 emphasizes rigorous design and performance standards to maintain safety and functionality during rescue operations. Key considerations include:

- **DYNAMIC AND STATIC TESTING:** All equipment must undergo extensive testing to ensure its performance under real-world conditions.
- **REDUNDANCY:** Rescue systems are designed with fail-safes to minimize risks during operation.
- **DURABILITY:** Equipment must withstand repeated use without degradation, even in harsh environments.

TRAINING & COMPETENCY

Proper training is a cornerstone of rescue system effectiveness. ANSI Z359.4 requires organizations to implement training programs to ensure personnel are:

- Competent in the use of rescue equipment.
- Familiar with system-specific procedures, including setup, operation, and maintenance.
- Able to perform rescues safely and efficiently under various conditions.

Training should also include regular drills to maintain readiness and identify areas for improvement.



MAINTENANCE & REMOVAL FROM SERVICE

To ensure ongoing compliance and safety, ANSI Z359.4 includes guidelines for the inspection, maintenance, and removal of equipment:

- **INSPECTION:** Regular checks are required to identify wear, damage, or other issues that could compromise performance.
- **MAINTENANCE:** Equipment must be serviced according to the manufacturer's recommendations to preserve functionality.
- **END-OF-LIFE CRITERIA:** Clear instructions are provided for removing equipment from service when it no longer meets safety requirements.

KEY APPLICATIONS & LIMITATIONS

While ANSI Z359.4 is primarily aimed at workplace rescue scenarios, it is not intended for emergency rescue situations where NFPA standards or other regulations apply. Employers must evaluate their specific needs and ensure compliance with the most appropriate standard for their environment.

CONCLUSION

ANSI Z359.4 provides a robust framework for rescue and evacuation systems, ensuring they are safe, reliable, and effective in pre-planned scenarios. By adhering to these guidelines, organizations can safeguard their workers and maintain compliance with industry best practices. This standard highlights the importance of meticulous planning, rigorous training, and regular equipment maintenance in fostering a culture of safety and preparedness.



OVERVIEW OF ANSI Z359.6:

CUSTOM-ENGINEERED FALL PROTECTION SYSTEMS

The ANSI Z359.6 standard is an essential resource for engineers involved in designing custom-engineered fall protection systems tailored for specific locations or purposes. These systems, often permanent installations, require a high degree of precision and compliance to ensure worker safety. While the standard excludes passive fall protection systems (e.g., guardrails, safety nets) and work positioning systems, it provides comprehensive guidelines for active fall protection systems. Employers, facility owners, and system users can utilize this standard to communicate design requirements effectively to engineering teams and contractors.

DOCUMENTATION: DRAWINGS & SPECIFICATIONS

Every engineered fall protection system must be thoroughly documented to ensure clarity, precision, and compliance. Key requirements include:

- **PROFESSIONAL ENGINEER OVERSIGHT:** Drawings and specifications must be prepared under the guidance of a licensed professional engineer and stamped with their official seal. If the engineer is the system designer, they must be registered in the state where the work is performed.
- **REQUIRED DOCUMENTATION:** Detailed drawings and specifications should include the following:
 - System layout.
 - Anchor point locations and capacities.
 - Materials and hardware specifications.
 - Load and clearance calculations.
 - Installation and inspection guidelines.

This rigorous documentation ensures the system meets safety and regulatory standards and facilitates maintenance over its lifespan.

DESIGN REQUIREMENTS: MATERIALS, EQUIPMENT, & HARDWARE

Engineers must ensure the fall protection system is designed with components that comply with the ANSI Z359 Fall Protection Code. Key considerations include:

- **COMPONENT COMPATIBILITY:** Manufactured fall protection components, such as harnesses, connectors, and lanyards, must integrate seamlessly into the overall system.
- **FORCE LIMITS AND SAFETY FACTORS:**
 - **Maximum Arrest Force:** The system must limit fall arrest forces to 1,800 pounds or less.
 - **Safety Factor:** A minimum safety factor of two times the maximum anticipated load must be maintained.
- **ADEQUATE CLEARANCE:** Engineers must ensure sufficient clearance in the fall path to prevent contact with obstacles or the ground during a fall.

STRENGTH, FORCES, & CLEARANCE CRITERIA

STRENGTH CALCULATIONS:

The standard provides comprehensive formulas and methodologies for calculating the strength requirements of fall protection systems. Engineers must account for:

- **FACTORED RESISTANCE:** Load-bearing components must meet specified resistance levels.
- **MATERIAL PROPERTIES:** The standard includes guidance for materials not covered by other ANSI codes.

FORCES ON THE BODY

The system must minimize forces transmitted to the body during a fall to reduce injury risks, adhering to the maximum arrest force threshold of 1,800 pounds.

CLEARANCE DISTANCES

Clearance calculations are vital to prevent workers from striking objects or the ground during a fall. Factors influencing clearance include:

- **FREE FALL DISTANCE:** The vertical distance a worker falls before the fall arrest system engages.
- **DECELERATION DISTANCE:** The distance traveled while the energy-absorbing system slows the fall.
- **HARNESS STRETCH:** The elongation of the harness under load.
- **SWING FALL DISTANCE:** Lateral movement during a fall if the anchor point is not directly above the worker.
- **SAFETY MARGIN:** Additional clearance to account for unforeseen conditions.

Different clearance requirements apply depending on whether the system uses rigid (e.g., overhead tracks) or flexible (e.g., cable lifelines) anchor systems.



LOAD & FORCE CALCULATIONS

The standard provides methodologies for determining forces applied to fall protection systems during use. Engineers must account for:

- **HORIZONTAL LIFELINES (HLLS):** Calculations for single and multiple-span systems, factoring in sag, tension, and dynamic loads during a fall.
- **MULTIPLE WORKERS:** The impact of simultaneous falls by multiple workers on the same system must be considered to ensure structural integrity.

These calculations are critical for ensuring the system can withstand real-world conditions.

CLEARANCE FOR FALL ARREST SYSTEMS

Accurately determining clearance requirements is among the most critical tasks in fall protection system design. The engineer must evaluate:

- **SYSTEM-SPECIFIC VARIABLES:** Each system's fall clearance will vary based on the type of anchor system and the worker's position relative to the anchor.
- **RIGID ANCHOR SYSTEMS:** Typically require less clearance due to minimal system deflection.
- **FLEXIBLE ANCHOR SYSTEMS:** Require additional clearance to account for cable sag and elasticity.

By considering all these factors, the system ensures workers remain safe even in the event of a fall.

APPLICATIONS & LIMITATIONS

The ANSI Z359.6 standard focuses on active fall protection systems designed for specific sites and purposes. It provides engineers with the flexibility to develop systems tailored to unique environments while adhering to strict safety criteria. However, it does not apply to:

- Passive systems like guardrails and nets.
- Manufactured fall protection components that already meet Z359 standards.
- Systems designed for temporary or short-term use.

Employers and owners must collaborate with qualified engineers to ensure the system's suitability and compliance with regulatory standards.

CONCLUSION

The ANSI Z359.6 standard is indispensable for engineers tasked with designing custom-engineered fall protection systems. Its detailed guidelines ensure these systems meet stringent safety, performance, and documentation requirements, offering long-term reliability and protection for workers in hazardous environments. By adhering to this standard, stakeholders can ensure their fall protection systems are not only compliant but also optimized for the safety of their workforce.



OVERVIEW OF **ANSI Z359.7:**

QUALIFICATION & VERIFICATION TESTING FOR FALL PROTECTION PRODUCTS

ANSI Z359.7 provides a rigorous framework for the qualification and verification testing of fall protection products, ensuring safety, reliability, and compliance across the industry. This standard defines the procedures, testing requirements, and laboratory standards necessary to validate the performance of components, subsystems, and systems within the Z359 Fall Protection Code.

SCOPE OF THE STANDARD

The standard applies to all fall protection products, including their packaging, markings, and instructions, as sold by manufacturers. Compliance with the complete and most current edition of the relevant Z359 standards is required, and products cannot claim partial compliance. Testing must validate that products meet all specified criteria, ensuring they perform safely under real-world conditions.

TESTING LABORATORIES FOR FALL PROTECTION PRODUCTS

Testing may be conducted by:

- 1. THIRD-PARTY ACCREDITED LABORATORIES:** Independent labs must be accredited to ISO 17011 and ISO 17025 to ensure their competence in testing and documentation.
- 2. MANUFACTURER LABORATORIES:** In-house labs may perform testing but must adhere to the same accreditation standards. Testing must be verified or witnessed by a qualified professional engineer or an accredited third-party representative.

These requirements maintain consistency and reliability in testing procedures across the industry.

TESTING EQUIPMENT & SETUP

DROP TEST STRUCTURE

The drop test structure must meet stringent criteria to ensure accurate results:

- **CLEARANCE:** Sufficient space within the drop zone to avoid obstructions or interference.
- **ANCHORAGE AND CONNECTOR REQUIREMENTS:** Minimum natural frequency and maximum elastic deformation are specified to maintain the integrity of the test structure.

TEST WEIGHT AND TEST TORSO

The standard prescribes a **310-pound test weight** for most evaluations, though specific requirements may vary depending on the type of test. Precise specifications for size, mass, and center of gravity are outlined in the respective Z359.7 standards.

TEST INSTRUMENTATION

Instrumentation must meet high accuracy and resolution standards:

- **LOAD CELL:** Must register peak loads within **0.5% of its range**.
- **SAMPLING RATE AND CORNER FREQUENCIES:** Ensure precise data capture during testing.



TESTING REQUIREMENTS

QUALIFICATION TESTING

Qualification testing ensures a product's initial compliance with the Z359 standard. Requirements include:

- Testing **at least three specimens** of each product.
- Using new, unused, regular production units from a standard production lot.
- Conducting tests in accordance with the manufacturer's specifications and the most current Z359 standards.

VERIFICATION TESTING

Verification testing ensures ongoing compliance throughout a product's lifecycle:

- Testing **at least one sample** of each compliant product.
- Periodic retesting to confirm that production units continue to meet all performance requirements.

Both qualification and verification testing ensure that fall protection products maintain their reliability and safety over time.

FALL PROTECTION PRODUCT TESTING OPTIONS

ANSI Z359.7 promotes consistent testing methodologies across third-party and manufacturer laboratories:

- 1. THIRD-PARTY TESTING:** Independent verification by accredited labs ensures impartiality and compliance.
- 2. MANUFACTURER LABORATORIES:** Permitted to conduct testing if the process is witnessed or verified by a qualified third-party representative or professional engineer.

This dual approach balances the need for rigorous testing with operational flexibility for manufacturers.

MANUFACTURER RESPONSIBILITIES

Manufacturers play a critical role in ensuring product compliance throughout its lifecycle. Responsibilities include:

- 1. DOCUMENTATION:** Maintaining detailed records of design, performance evaluations, and testing for each product model during production and for several years post-production.
- 2. MODIFICATIONS:** Any design or material changes that could affect product performance require additional testing to validate compliance with the applicable standards.
- 3. QUALITY ASSURANCE:** Providing complete, production-identical units for testing ensures consistency between tested samples and products available to end users.

KEY ELEMENTS OF COMPLIANCE

To achieve compliance, fall protection products must:

1. Be tested using procedures and equipment that conform to ANSI Z359.7.
2. Meet all requirements of the relevant Z359 standards in their entirety.
3. Demonstrate consistent performance across all tested specimens.

This comprehensive approach ensures that every fall protection product provides reliable performance under anticipated use conditions.

CONCLUSION

ANSI Z359.7 establishes the foundation for rigorous qualification and verification testing of fall protection products. By requiring adherence to stringent testing methodologies, laboratory accreditation, and ongoing compliance verification, the standard ensures that products meet the highest safety and reliability benchmarks. Manufacturers, testing laboratories, and end-users can rely on this standard to maintain confidence in the integrity and performance of fall protection systems.

UNDERSTANDING ANSI Z359.12:

CONNECTING HARDWARE STANDARDS FOR FALL PROTECTION

The ANSI Z359.12 standard is a critical document for fall protection equipment manufacturers, focusing on the design and testing of connecting hardware. This hardware includes components such as snap-hooks, carabiners, D-rings, oval rings, and O-rings, which are integral to fall protection systems. While carabiners are often sold as standalone products, other hardware components are typically incorporated into full-body harnesses, lanyards, and similar equipment. By establishing stringent design and testing requirements, ANSI Z359.12 ensures the reliability and safety of connecting hardware, directly enhancing the protection provided to end users.

DESIGN & TESTING CRITERIA

The standard outlines a robust set of requirements to evaluate the performance and durability of connecting hardware under real-world conditions. These include:

MINOR AXIS LOAD TESTING

- **PURPOSE:** Prevents failure due to gate loading in snap-hooks and carabiners without a captive eye feature.
- **FAILURE MODE ADDRESSED:** "Roll-out," a scenario where fall forces exert pressure against the gate, causing it to disengage from the connector body.
- **TESTING PROCEDURE:** The test simulates a worst-case loading configuration to ensure the gate remains secure under minor axis loading conditions.

DYNAMIC LOAD TESTING

- **PURPOSE:** Identifies potential design weaknesses that static tests may not reveal.
- **SIMULATION OF IMPACT FORCES:** Hardware is subjected to dynamic forces that mimic the high-energy impacts experienced during accidental falls.
- **ENVIRONMENTAL CONDITIONING:** Before testing, hardware undergoes simulated real-world conditions, such as:
 - **Abrasion:** Mimicking wear and tear.
 - **UV Exposure:** Evaluating resistance to sunlight.
 - **Cold Temperature Exposure:** Testing performance in extreme conditions.

STATIC LOAD TESTING

- **MINIMUM BREAKING STRENGTH:** Hardware must withstand static forces up to 5,000 pounds without failure.
- **PROOF LOAD TESTING:** Each piece of hardware is tested at 3,600 pounds to verify manufacturing consistency.

CORROSION RESISTANCE

The standard includes rigorous tests to assess the hardware's durability in corrosive environments:

- **SALT SPRAY EXPOSURE:** Simulates prolonged exposure to corrosive elements to ensure the hardware maintains its structural integrity over time.

This testing ensures that components like carabiners, snap-hooks, D-rings, and O-rings are resistant to environmental degradation, extending their service life.

MARKINGS & INSTRUCTIONS

Clear, permanent markings are a vital component of ANSI Z359.12, ensuring that users can easily identify the strength and compliance of each piece of hardware:

- **MAJOR AXIS STRENGTH:** Marked with values such as "22K" or "5,000 lbs", representing the connector's capacity along its strongest axis.
- **GATE STRENGTH:** Gates are tested for static loads applied to the gate face, side, and inside the gate. Markings such as "3,600 lbs" or "16K" indicate the gate's tested strength.
- **COMPLIANCE MARKINGS:** Hardware sold separately, like carabiners, must display a marking indicating compliance with ANSI Z359.12.

These markings provide users with critical information about the hardware's capacity and compliance, helping to ensure safe use in the field.

KEY HARDWARE PERFORMANCE REQUIREMENTS

- **DYNAMIC AND STATIC STRENGTH:** All connectors must withstand both dynamic impact forces and static loads.
- **GATE INTEGRITY:** The gate design must resist roll-out and maintain security under all tested conditions.
- **CORROSION RESISTANCE:** Components must endure simulated harsh environments without compromising performance.
- **PROOF TESTING:** Each unit undergoes a proof test to verify its strength before entering the market.

APPLICATIONS OF ANSI Z359.12

The standard applies broadly to connecting hardware in fall protection systems across various industries, including construction, utilities, and manufacturing. By setting clear benchmarks for performance and durability, it ensures that these critical components provide consistent safety in diverse and challenging environments.

CONCLUSION

ANSI Z359.12 establishes comprehensive requirements for the design, testing, and marking of connecting hardware used in fall protection systems. Through rigorous testing protocols and detailed performance criteria, the standard ensures that manufacturers produce reliable and durable hardware. This commitment to quality not only enhances the safety of fall protection systems but also instills confidence in both equipment owners and end-users. By adhering to ANSI Z359.12, manufacturers play a crucial role in reducing fall-related injuries and fatalities in the workplace.

UNDERSTANDING ANSI Z359.13:

ENERGY ABSORBERS AND ENERGY-ABSORBING LANYARDS

The ANSI Z359.13 standard establishes detailed requirements for personal energy absorbers and energy-absorbing lanyards, critical components of fall protection systems. These guidelines ensure that these products meet rigorous performance, testing, and labeling standards, enhancing worker safety and compliance in a variety of environments.

CLASSIFICATIONS FOR PERSONAL ENERGY ABSORBERS AND LANYARDS

The standard introduces two classifications for energy absorbers, each tailored to specific fall distances:

1. CLASS A - 6 FT. FREE FALL (FF) PERSONAL ENERGY ABSORBER:

- Designed for scenarios where the total free-fall distance is 6 feet or less.
- Intended for overhead anchor points that limit free fall.

2. CLASS B - 12 FT. FREE FALL (FF) PERSONAL ENERGY ABSORBER:

- For situations where free-fall distances may reach up to 12 feet.
- Ideal for scenarios where workers must tie off at foot-level anchor points, such as steel beams.
- Maintains arrest forces within OSHA's limit of 1,800 pounds despite the extended fall distance.

This classification system ensures workers can select appropriate equipment based on their work environment and potential fall risks.

PERFORMANCE SPECIFICATIONS

The standard defines key performance criteria for energy absorbers:

1. MAXIMUM ARREST FORCE (MAAF):

- The maximum allowable force exerted on a worker during a fall arrest is **1,800 lbs.**

2. MAXIMUM DEPLOYMENT DISTANCE (MDD):

- **For 6 ft. FF absorbers:** Maximum deployment distance is **48 inches.**
- **For 12 ft. FF absorbers:** Maximum deployment distance is **60 inches.**

These specifications ensure that energy absorbers effectively decelerate falls while limiting the forces transmitted to the worker.

APPLICATIONS & BENEFITS

The ANSI Z359.13 standard is particularly valuable in industries like construction, utilities, and manufacturing, where fall hazards vary widely. The introduction of the 12 ft. FF energy absorber class expands the range of scenarios where energy-absorbing lanyards can be safely and effectively used, including work with foot-level tie-off points. By ensuring consistent performance under rigorous conditions, this standard helps prevent injuries and fatalities, providing both workers and employers with confidence in their fall protection systems.

ADDITIONAL TESTING REQUIREMENTS

To simulate real-world conditions and enhance product reliability, the standard introduces rigorous testing protocols:

1. ENVIRONMENTAL CONDITIONING:

- Products are exposed to hot, cold, and wet environments to ensure consistent performance across diverse conditions.

2. ABRASION RESISTANCE:

- Lanyard leg materials undergo prolonged abrasion tests to replicate wear in harsh environments.

3. STATIC STRENGTH TESTING:

- Energy-absorbing lanyards must withstand static forces of twice the maximum loads a fall imposes, ensuring their durability and reliability.

These additional tests help manufacturers produce equipment that can perform reliably under extreme conditions, falls while limiting the forces transmitted to the worker.

MARKINGS & INSTRUCTIONS

Clear and distinct labeling is essential for differentiating between the two classes of energy absorbers:

1. 6 FT. FF PERSONAL ENERGY ABSORBERS:

- Marked with large black letters on a white background.
- Includes labels indicating "6 feet maximum free fall" and a 900 lbs. average arrest force.

2. 12 FT. FF PERSONAL ENERGY ABSORBERS:

- Marked with large white letters on a black background.
- Includes labels indicating "12 feet maximum free fall" and a 1,350 lbs. average arrest force.

These markings ensure workers can easily identify and select the correct equipment for their needs.

CONCLUSION

ANSI Z359.13 sets the benchmark for energy absorbers and energy-absorbing lanyards, ensuring these critical fall protection components are designed, tested, and labeled to the highest safety standards. With its comprehensive classification system, rigorous performance criteria, and detailed testing protocols, the standard enables workers to choose equipment that matches their specific needs, reducing risks and enhancing workplace safety.



OVERVIEW OF ANSI Z359.14:

REQUIREMENTS FOR SELF-RETRACTING DEVICES (SRDS)

The ANSI Z359.14 standard establishes rigorous requirements for the design, performance, testing, use, and inspection of Self-Retracting Devices (SRDs). These devices play a critical role in fall protection systems, ensuring the safety and mobility of workers at height. The standard categorizes SRDs into three distinct types and provides detailed guidelines for inspection and maintenance.

TYPES OF SELF-RETRACTING DEVICES (SRDS)

- 1. SELF-RETRACTING LANYARD (SRL):** A mechanical fall arrester featuring a locking mechanism and energy management system to arrest falls and limit forces on the user.
- 2. SELF-RETRACTING LANYARD, PERSONAL (SRL-P):** Compact enough to be worn on a full-body harness. Can serve as a fall arrest connector or be anchored. Some models allow dual configuration for 100% tie-off.
- 3. SELF-RETRACTING LANYARD WITH RESCUE CAPABILITY (SRL-R):** Incorporates features for rescue operations, including a rescue mode that:
 - Engages without accidental activation.
 - Offers a **3:1 mechanical advantage** for raising or lowering a load.
 - Automatically holds the load when control is relinquished.
 - Has a static strength of **3,100 pounds**.

GENERAL REQUIREMENTS FOR SRDS

- 1. INTEGRAL CONNECTORS:** Snap-hooks and carabiners must comply with ANSI Z359.12. Connection points must eliminate the risk of rollout.
- 2. VISUAL LOAD INDICATOR:** A visual impact indicator must activate during a fall to signal that the device has been exposed to arrest forces.
- 3. RETRACTION TENSION:** Retraction tension of the SRD line must remain between 1.25 and 25 pounds throughout its range of motion.

CLASSIFICATIONS OF SRDS

1. CLASS 1 SRDS:

- Designed for overhead anchorages with a maximum free fall of 2 feet.
- Anchorage must be at or above the user's dorsal D-ring.

2. CLASS 2 SRDS:

- Intended for use in leading-edge work where overhead anchorages may not be feasible.
- Allows a free fall of up to **6 feet**.
- Anchorage can be above, at, or up to 5 feet below the dorsal D-ring.



INSPECTION & MAINTENANCE

Regular inspections are critical to ensuring SRD safety and functionality. Inspection frequency is determined by usage type and environmental conditions:

FREQUENCY BASED ON USE

1. INFREQUENT TO LIGHT USE:

- Indoor or infrequent outdoor use in clean environments.
- Annual inspections; additional inspections every 2-5 years as needed.

2. MODERATE USE:

- Extended outdoor use, clean or dusty environments.
- Inspections every 6-12 months.

3. HEAVY USE:

- Construction, utilities, and harsh conditions.
- Inspections every 3-6 months.

4. SEVERE/CONTINUOUS USE:

- Extreme environments such as mining or oil and gas.
- Inspections every quarter.

INSPECTION PROCESS

Inspections must be performed by a competent person other than the user or by a factory-authorized entity. Inspections should identify defects or damage, such as:

1. HARDWARE ISSUES:

- Cracks, sharp edges, deformation, corrosion, or excessive wear.
- Defects affecting connectors, housings, or mechanical components.

2. WEBBING AND ROPE:

- Fraying, crushing, kinking, or chemical damage.
- Broken stitches or wires and excessive elongation.

3. ACTIVATED INDICATORS:

- Check if the visual load indicator has been activated, indicating a fall event.

4. FUNCTIONALITY:

- Test retraction tension, locking mechanisms, and warning devices.

DOCUMENTATION & MAINTENANCE

Employers must maintain detailed inspection records, including:

- Equipment identity.
- Inspection dates and results.
- Name of the competent inspector.

If any defects are found, the equipment must be removed from service and repaired or replaced following the manufacturer's instructions.

STORAGE & USER INSPECTIONS

- **STORAGE:** SRDs should be stored in clean, dry environments away from chemicals or UV exposure.
- **USER INSPECTIONS:** Before each use, workers must inspect for visible defects, damage, or warning activations.

KEY FEATURES OF SRL-R (RESCUE-CAPABLE DEVICES)

SRL-Rs provide integrated rescue functionality for enhanced safety during emergencies:

- **RESCUE MODE:** Allows controlled raising or lowering of a load with a mechanical advantage.
- **STABILIZATION:** Devices include mechanisms to ensure stability during rescue operations.

These features make SRL-Rs ideal for environments requiring both fall protection and emergency preparedness.

CONCLUSION

ANSI Z359.14 establishes a comprehensive framework for the design, use, inspection, and maintenance of self-retracting devices. By adhering to these guidelines, manufacturers and employers can ensure the safety, reliability, and longevity of SRDs in a wide range of applications. With its focus on performance, classification, and maintenance, this standard helps mitigate fall risks and promotes worker confidence in their fall protection systems.

