



## **2600SEG109 SAFETY STANDARD FOR FALL PROTECTION**

### **1.0 PURPOSE**

The purpose of this standard is to establish guidelines to prevent employees from being injured by falling objects or due to falls from surfaces located over 1.8 m (6 feet) high.

### **2.0 BACKGROUND INFORMATION**

Although working in high surfaces is one of the most risky activities, the Panama Canal Authority (ACP) does not have a set of standards to regulate this activity.

### **3.0 SCOPE**

This standard applies to all ACP employees, contractors, and other individuals who work or develop activities in teams, facilities, or areas under the responsibility of the ACP.

### **4.0 LEGAL FOUNDATION**

This Standard is established pursuant to Agreement No. 12 of the Board of Directors of the Panama Canal Authority (ACP), Safety and Health Regulations, Chapter 1, Article 3, paragraphs 3 and 4.

### **5.0 DEFINITIONS**

For the purposed of this standard, the following definitions are hereby established:

**5.1** Competent person: Employee responsible for taking immediate corrective actions to control or eliminate risks due to falls from high surfaces.

**5.2** Qualified person: Employee responsible for designing and/or preparing a fall protection plan and system for a specific job.

**5.3** Lanyard: Double threaded synthetic rope, cable or strap, 3 to 6 feet long, used to link the full body harness to the anchor point. Must have double-action locking connectors at each end. It may also include a deceleration device.

**5.4** Lifeline: Synthetic rope with a minimum 5000 lb rupture resistance used as anchor for fall protections systems. Lifelines may be vertical or horizontal. They are tied to fix anchors.

**5.5** Connector: A mechanical device that allows hooking the lifeline to a ring in the harness or to an anchorage. It must be made of forged steel, resistant to corrosion, with double-action lock, and a minimum 5000 lb tensile resistance. It may be independent (like a D ring) or be part of a system (like the lifeline). It must be compatible with the devices to which they are connected.

**5.6** Anchorage: The point where fall protection devices, lifelines, life ropes, etc., are secured. The anchor must be designed with a minimum 5000 lb resistance for each person hooked to it.

### **6.0 GENERAL**

**6.1** The first consideration shall always be the elimination of fall potential risks.

**6.2** Access to the working surface shall be through duly installed equipment, be they ladders, scaffolds, ramps or other.



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**6.3** Deteriorated or defective equipment shall not be used.

**6.4 FALL PROTECTION PLAN**

**6.4.1** A fall protection plan shall be prepared whenever fall potential risks may not be eliminated.

**6.4.2** Any change to the fall protection system or plan shall be approved by the qualified person prior to its implementation.

**6.5 PROTECTION AGAINST FALLING OBJECTS**

**6.5.1** Any person located in an area exposed to objects that may fall from a higher level to the area where the person is, shall use an approved hard hat.

**6.5.2** Should there be the risk of some object or substance falling into an area, access to the area must be restricted by means of a barricade, or the object or substance secured.

**6.5.3** While work is being performed on high surfaces, horizontal covers or toe boards shall be installed on the edges, in order to prevent objects from falling.

**6.5.3.1** Toe boards shall be at least 9 centimeters (3.5 inches) high, support a 22.7 Kg (50 lb) horizontal force applied in any direction and not have openings greater than 0.6 cm (0.25 inches) between the working surface and the lower part of the toe board.

**6.5.4** If accumulating tools or materials that are higher than the toe board is required, an additional barrier must be installed.

**6.5.5** During roof works, all materials shall be placed at 1.8 m (6 feet) or more from the edge.

**6.6 ENGINEERING CONTROLS AND MEASURES**

**6.6.1 GUARDRAILS SYSTEMS**

**6.6.1.1** Guardrails systems may be installed to cover unprotected holes on the floor.

**6.6.1.1.1** When guardrails are used to cover access holes, a cover must be placed on them while they are not being used.

**6.6.1.2** Guardrails shall be installed on the edges of ramps, ladders, and access surfaces to high areas.

**6.6.1.3** If natural or synthetic fiber ropes are being used as guardrails, they shall be inspected regularly. This inspection shall be documented in writing.

**6.6.1.4** The top rail of the guardrail shall be between 0.99 and 1.13 meters (39 and 42 inches) over the working surface.

**6.6.1.5** The mid rail shall be at 0.53 meters (21 inches) over the working surface.



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**6.6.1.6** A safety screen or mesh may be installed along the entire guardrail, which shall extend from the top rail to the working surface.

**6.6.1.7** Guardrail stanchions shall be separated by a distance not exceeding 2.5 meters (8 feet).

**6.6.1.8** The handrail shall be capable of withstanding at least 100 Kg (200 lb) applied in any direction without deflection reducing its height to less than 1.0 meters (39 inches) over the working surface.

**6.6.1.9** If the guardrail is built in wood, it should measure at least 50x100 mm (2"x4") and of finished wood.

**6.6.1.10** Central posts, safety nets, and lower parts shall be capable of withstanding a static force of 75 Kg (150 lbs), applied in any direction.

**6.6.1.11** Handrail ends shall not overhang the terminal stanchions unless they do not represent any hazard.

**6.6.1.12** Plastic or metallic banding shall not be used as guardrails.

**6.6.1.13** If a cable is used as guardrail, the cable shall be at least 0.6 cm (0.25 inches) in diameter, be flagged at 1.8 m (6 feet) intervals with a highly visible material (for example: triangular reflective flags) and not have loose threads or braids.

**6.6.2 SAFETY NETS**

Safety nets shall:

**6.6.2.1** Be installed as close as possible to the working surface and never at more than 30 feet (9 meters) below the working surface.

**6.6.2.2** Be placed according to the following table:

Minimum vertical distance from the level of the working surface to the horizontal plane where the net is located.	Minimum horizontal distance from the edge of the level of the working surface to the outer edge of the net.
Up to 5 feet	8 feet
Over 5 feet, up to 10 feet	10 feet
Over 10 feet, up to 30 feet	13 feet

**6.6.2.3** Be tested at the working site after being installed and prior to being used as fall protection systems; when they are relocated, after a major repair; and every 6 months. Nets shall be installed so that they prevent contact between the load and surfaces below the net.

**6.6.2.4** Be carefully inspected by a competent person at least once a week for wear and tear, damages or other sorts of deterioration of their components. All defective parts shall immediately be replaced.

**6.6.2.5** Be kept free from debris, pebbles, tools, or any material whatsoever that may fall on them.



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**6.6.2.6** The maximum size of net openings shall not exceed 36 square inches (225 cm<sup>2</sup>). Opening sides or diameters shall not exceed 6 inches, including after being subject to a load.

**6.6.2.7** The ropes that web the nets shall withstand a 5,000 lbs minimum rupture force.

**6.6.3 SAFETY MONITORING SYSTEMS**

**6.6.3.1** This system shall only be applied to works performed on low inclination roofs (<18°) and shall be utilized together with the warning lines system, pursuant to the provisions of section 6.3.4 WARNING LINES SYSTEM. Only employees performing the specific job will have access to the protected area.

**6.6.3.2** Mechanic equipment must not be used and materials must not be stored in working areas where the safety monitoring system is in place.

**6.6.3.3** The safety monitor shall be designated by the administration of the operational unit and shall:

**6.6.3.3.1** Be authorized as competent person in fall protection and to exercise his duties in a free and discretionary manner.

**6.6.3.3.2** Remain at the same level as the other workers so that he may be seen and warn them about fall risks. Be close enough to communicate orally with the other workers.

**6.6.3.3.3** Devote entirely to the monitoring function and not have other assigned duties.

**6.6.4 WARNING LINES SYSTEM**

**6.6.4.1** Consists of synthetic ropes, cables or chains, and the equipment that holds them, and shall be used together with guardrail systems, safety nets, personal fall arrest systems, or a safety monitoring system, and shall comply with the following:

**6.6.4.1.1** Lines shall be marked at intervals not exceeding 6 feet (1.8 meters) with a highly visible material, and supported in such a way that the lowest point (including the sine produced when a load is applied) is never at less than 34 inches (0.9 meters) from the working surface.

**6.6.4.1.2** Warning lines and stanchions shall withstand, without sagging, turning over, or falling, a 16 lbs force applied horizontally at 30 inches over the working surface and perpendicular to the warning line.

**6.6.4.1.3** The lines shall have a minimum tensile strength of 500 lbs.

**6.6.4.1.4** Systems shall be designed and supported so that when the line is pulled from one side it does not cause a slack in the adjacent section line.

**6.6.4.1.5** When using mechanical equipment, warning lines shall be installed at 6' from the edge parallel to the equipment's operation and at 10' from the edge perpendicular to the equipment's operation.



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**6.6.4.1.6** Workers shall not be allowed access to the area between warning lines and the roof's edge, unless they are working in this area and duly protected against falls.

**6.6.4.1.7** Warning lines shall be installed at no less than 6 feet (1.8 meters) from the edge of the roof surface.

**6.6.5 PROTECTION COVERS**

**6.6.5.1** Covers used to protect access areas in roadways and vehicular aisles shall resist at least twice the maximum axle load of the largest vehicle expected to pass by.

**6.6.5.2** Covers for people to pass by shall withstand twice the weight of the persons, tools, or equipment that they may pass over them, and shall be secured to prevent them from moving.

**6.6.5.3** All covers shall be painted according the color code in force at each working area or marked with the word "COVER".

**6.6.5.4** They shall be inspected at the beginning of each shift by a qualified person to verify that they are kept in good repair and secured in their position.

**6.6.6 PERSONAL FALL ARREST SYSTEM**

**6.6.6.1** Fall arrest systems shall be designed by qualified persons.

**6.6.6.2** This system consists of an anchor, a lanyard, a connector and a safety harness or positioning belt combined with a safety harness. It may also include a deceleration device, a lifeline (horizontal or vertical) or another combination.

**6.6.6.3** Every personal fall arrest system shall comply with then ANSI Z359.1-1992 standard, as well as with the following parameters:

**6.6.6.3.1** Limiting the maximum fall arresting force on an employee to 1,800 lbs-force when using a full body harness.

**6.6.6.3.2** Be used the shortest lanyard)length possible to allow the user the required movements to perform his job, which length prevents the employee from free falling more than 6 feet (1.8 m) or from hitting an object situated at a lower level.

**6.6.6.3.3** Completely stopping an employee's fall and limiting the deceleration distance to 3.5 feet (1.07 meters).

**6.6.6.3.4** Having enough strength to withstand twice the potential energy from the impact of an employee falling 6 feet (1.8 meter) or the free fall allowed by the system, whichever is less.

**6.6.6.4** Only locking snaphooks are allowed to anchor personal fall arrest systems. Using knots to anchor lanyards is not allowed.



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**6.6.6.4.1** It shall be forbidden to connect fall arrest systems snaphooks above themselves, to another lanyard, to a D ring with another hook anchored to it, or directly to a horizontal or vertical lifeline.

**6.6.6.4.2** It shall be forbidden to anchor fall arrest systems to guardrails or ladders, unless they have been designed considering this possibility.

**6.6.6.4.2.1** All anchors for personal fall arrest equipment shall be marked or identified to that end, be independent from those hooks used to anchor any other person or equipment, and be capable of withholding a static load of 5,000 lbs-force.

**6.6.6.4.2.2** Anchors for fall arrest equipment shall be painted in orange.

**6.6.6.4.3** Every personal fall arrest system shall be inspected prior to its use and periodically as per manufacturer recommendations.

**6.6.6.4.4** It is hereby forbidden to use body belts as the only personal fall arrest system.

**6.6.7 POSITIONING SYSTEMS**

**6.6.7.1** These systems consist of harnesses or positioning belts worn so as to prevent a worker from falling down to a distance exceeding 2 feet (0.6 meters)).

**6.6.7.2** They must be secured to an anchor point that may withhold twice the energy of the impact or 3,000 lbs-force, whichever is greater.

**6.6.7.3** Positioning belts may only be used together with a harness, never by themselves.

**6.7 ADMINISTRATIVE MEASURES AND CONTROLS**

**6.7.1 SAFETY PROCEDURES**

**6.7.1.1** Prior to initiating works at height, a supervisor shall develop a work plan and discuss it with the employees who will perform the job.

**6.7.1.2** There shall be a rescue plan for all works at height, as well as the necessary equipment to carry it out in case of a fall.

**6.7.1.3** Workers shall be trained in rescue procedures at height depending on the rescue plan in force.

**6.7.1.4** All employees working at high altitudes shall carry the personal protection equipment required for the risk that may be present.

**6.7.1.5** A physical safety barrier shall be placed at the work area prior to initiating works at height, in order to prevent the access of unauthorized personnel from entering said area.



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**6.8 PURCHASING**

The specifications found in the Purchasing Manual of the ACP shall be consulted for purchasing personal fall protection equipment.

**6.9 STORAGE**

Fall protection equipment shall be stored in order to avoid their deterioration or damage.

**6.10 DISPOSITION**

**6.10.1** The fall protection system that has been exposed to impact loads shall be removed from service and not be utilized again until it has been inspected by the competent person. All equipment that is not adequate for use shall be removed from use and marked "NOT TO BE USED"; and all employees shall be forbidden to use it.

**7.0 TRAINING**

**7.1** Any employee that may be exposed to fall hazards shall be trained. Contractor shall provide training for their own employees.

**7.2** Fall protection courses shall be coordinated with the Safety and Industrial Hygiene Unit (RHSH) and the Industrial and Safety Training Unit (RHSI).

**8.0 RESPONSIBILITY**

**8.1** The duties to be performed in order to guarantee compliance with this standard are described in the ACP Safety and Occupational Health Management Standard.

**8.2** Managers are responsible for demanding compliance with and supplying the resources to apply this standard.

**8.3** Supervisors are responsible for supplying all required equipment, making sure employees are trained, and seeing that this standard is complied with.

**8.4** Employees are responsible for the care, maintenance, and correct use of all protection equipment assigned to them and shall follow all instructions from their supervisor and form the equipment manufacturer.

**9.0 INQUIRIES**

Any information or clarification of the content or application of this Standard must be requested in writing to the Safety and Industrial Hygiene Unit (RHSH).

**10.0 EXCEPTIONS**

**10.1** Temporary digressions or exceptions to the compliance with these standards shall be requested in writing to the Safety and Industrial Hygiene Unit

**10.2** This standard does not apply to:

**10.2.1** The use of ladders and scaffolds.



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**10.2.2** Works in electric power transmission towers and posts, communication antennas, or similar structures.

**10.2.3** Metal covers, manhole covers and steel grills designed as protection covers for inspection chambers, duct works, and the like installed on sidewalks and streets.

**11.0 TERM**

This Standard shall remain in force until amended or revised.

**12.0 REFERENCES**

**12.1** ACP Safety and Occupational Health Manual. Revision of January 2000.

**12.2** ANSI Z359.1-1992.