



# What is Fall protection?

The Occupational Safety and Health Administration's (OSHA's) fall protection standard deals with both human and equipment-related issues. The standard identifies areas or activities where fall protection is needed.

For effective fall protection, you must protect employees from fall hazards and falling objects whenever an employee is 6 feet or more above a lower level, and when workers could fall into or onto dangerous equipment from any height.

This rule clarifies what employers can do to provide fall protection for employees such as identifying and evaluating fall hazards, and providing specific training. Several OSHA standards cover requirements to provide fall protection for workers on scaffolds, cranes and derricks, steel erection, equipment used in tunneling, electrical transmission and distribution lines, and stairways and ladders.

Just as there are many types of workplaces, there are many types of fall protection. And each type of job requires the best method of fall protection. Employees working near unprotected sides and edges should use guardrail systems, safety net systems or personal fall-arrest systems.

Employees who work in hoist areas should use guardrail systems or safety net systems. However, if employees must lean through the opening or over the edge to receive or guide materials, a personal fall-arrest system should protect them.

When employees work near holes, such as skylights, they should use guardrail systems, safety net systems or hole covers. When formwork and reinforcing steel is necessary, safety net systems, personal fall-arrest systems and positioning device systems are the best choice.

A steady guardrail system is the best choice for any job involving ramps, runways or other walkways. For employees working near excavation sites, pits

or shafts, a guardrail system, hole covers, fences or barricades are the best protection systems.

When dangerous equipment is involved, and the fall would be less than 6 feet, a guardrail system or equipment guards are the acceptable. If the fall could be more than 6 feet, a guardrail system, a safety net system or personal fall-arrest system will suffice.

Any workers involved in overhand bricklaying and similar work should use guardrail systems, safety net systems, personal fall-arrest systems and the controlled access zones. Employees who must reach 10 inches below the walking/working surface should use guardrail systems, safety net system or personal fall-arrest systems.

For employees doing roofing work on low-sloped roofs, guardrail systems, safety net systems or personal fall-arrest systems are the best. However, combinations of a guardrail system and a warning line system; or a safety net system with a warning line system and a personal fall-arrest system; or a warning line system with a safety monitoring system would also work.

While working on steep roofs with toe boards, employees should use guardrail systems. On steep roofs without toe boards, a safety net system or a personal fall-arrest system would work.

When the work involves precast concrete erections and residential construction, guardrail systems, safety net systems and personal fall-arrest systems are the best methods of fall protection, although there are exceptions noted for both.

When employees are on, at, above or near wall openings where the outside bottom edge is 6 feet or more above lower levels, and the inside bottom edge of the wall opening is less than 39 inches above the walking/working surface, the workers should be protected by guardrail systems, safety net systems or personal fall-arrest systems.

## Systems criteria and practices

Employers should provide and install all fall-protection systems before employees begin work that exposes them to the fall hazards.

Guardrail systems mean a barrier erected to prevent employees from falling to lower levels. Guardrails constructed in accordance with Appendix B, 29 CFR 1926, subpart M will meet this requirement. Intermediate members, mid-rails, screens and mesh should withstand 150 pounds in any outward or downward direction.

Surface guardrail systems prevent punctures, lacerations or snagged clothing. Eliminate projection hazards by making sure the guardrail systems do not extend past the terminal post. Ensure top-rails and mid-rails are one-quarter inch in diameter or greater to prevent cuts or lacerations. Do not use steel or plastic banding. When wire rope is used as a top-rail, flagging with highly visible material is required at 6-foot intervals.

Use a chain, gate or removable guardrail section at hoist openings, and replace it when not in use. When using a personal fall-arrest system, rig it so employee movement is restricted to the edge of the walking/working surface.

A hole for fall-protection purposes means a gap or void of at least 2 inches in its least dimension in a walking or working surface. Install guardrail systems that protect holes on all open sides. Make sure you can remove no more than two sides of a guardrail system. Offset the guardrail system at points of access, or provide a gate so employees cannot walk directly into the hole.

Covers are a method of protection for holes. Any covers in roadways should support at least twice the maximum axle load of the largest vehicle crossing the hole. Design other covers to carry at least twice the weight of employees, equipment and materials that may travel over them. Secure the cover to prevent displacement by wind, equipment or employees. Color code or mark with the words HOLE or COVER to provide hazard warning. Erect guardrail systems used on ramps and runways on each unprotected side.

Conduct and document frequent and regular inspections to ensure that manila, plastic or synthetic rope will withstand a force of 200 pounds applied in a downward or outward direction.

## Safety nets

Safety nets need sufficient clearance to prevent contact with objects below. Install nets capable of absorbing the impact force of a drop test, which you should perform and document at the job site. The drop test consists of a 400-pound bag of sand, 30 inches, plus or minus 2 inches, in diameter, dropped from the highest walking/working surface where employees are exposed to fall hazards, but not from less than 42 inches above that level.

If the employer can demonstrate that a drop test is unreasonable, a competent person can prepare a certification record that the net can withstand the impact force equal to the drop test.

When safety nets are inspected once a week, look for wear, damage and other deterioration. Remove defective nets from service. Clear material, scrap and equipment caught in the safety net as soon as possible and at least before the next work shift.

The maximum opening of the safety net should not exceed 36 square inches and be no longer than 6 inches on any side. When measuring center to center, the rope or webbing should not exceed 6 inches. The breaking strength of border rope should be 5,000 pounds minimum. Connectors need to be as strong as the integral net and spaced not more than 6 inches apart.

## Personal fall-arrest systems

Personal fall-arrest systems consist of anchorage, connectors and a body harness or body belt. A lanyard, deceleration device, lifeline or combinations of these may be included. Body belts are prohibited as primary fall-arrest equipment, though you can still use the belts in conjunction with other equipment.

Ensure connectors, devices used to link parts of the personal fall-arrest system and positioning device system, are drop-forged, pressed or formed steel, corrosion-resistant and smooth-surfaced to prevent damage to interfacing parts.

Deerings and snaphooks should have a minimum tensile strength of 5,000 pounds. When proof-tested to 3,600 pounds, they should not crack, break or take permanent deformation. Snaphook size should be compatible with other members to prevent unintentional disengagement. Use only locking-type snaphooks.

Suspended scaffolds or similar platforms with horizontal lifelines that may become vertical lifelines need a device capable of locking in both directions. Design, install and use horizontal lifelines under the supervision of a qualified person, as part of a complete personal fall-arrest system that maintains a safety factor of two.

Employees should have their own vertical lifelines with a breaking strength of at least 5,000 pounds. You may attach two employees to the same lifeline during elevator construction if they are working atop a false car equipped with guardrails and the lifeline breaking strength is 10,000 pounds. You must protect lifelines from being cut or abraded.

Self-retracting lifelines that do not limit the free-fall distance to 2 feet, and ripstitch, tearing and deforming lanyards, should have a minimum tensile load of 5,000 pounds when the device is fully extended. Self-retracting lifelines and lanyards that automatically limit the free-fall distance to 2 feet or less must have a minimum tensile load of 3,000 pounds.

You must use synthetic fibers in ropes, straps, lanyards and strength components of body belts and body harnesses.

Anchorage of personal fall-arrest equipment should support 5,000 pounds per employee. Do not anchor personal fall-arrest equipment to anything used to support or suspend platforms. Ensure equipment is designed, installed and used as part of a complete personal fall-arrest system with a safety factor of two, under a competent person's supervision. Do not attach a personal fall-arrest system to guardrail systems.

When using a body harness, you must limit the arresting forces to 1,800 pounds. Rigging should limit the free-fall distance to no more than 6 feet. Personal fall-arrest systems must bring employees to a complete stop and limit maximum decelera-

tion to 3.5 feet. Also, personal fall-arrest systems should have sufficient strength to withstand twice the potential impact energy of an employee free-falling 6 feet, or the free-fall distance permitted by the system.

A body belt's attachment point should be in the center of the wearer's back, while a body harness' attachment point should be at the center of the wearer's back near shoulder level or above the wearer's head.

Remove from service personal fall-arrest systems subjected to impact loading. Do not use until a competent person determines their suitability for reuse. Employers should provide prompt rescue in the event of a fall, or ensure employees can rescue themselves. Inspect each piece of fall-arrest equipment prior to use, and remove defective equipment from service.

Positioning device systems use a body harness rigged to allow support of an employee on an elevated vertical surface such as a wall, to work with both hands free while leaning. Rig positioning devices so employees cannot free fall more than 2 feet. The anchorage should support twice the potential impact load or 3,000 pounds, whichever is greater. The connectors should follow the same criteria as for fall-arrest equipment.

Proof-test dee-rings and snaphooks to a minimum tensile load of 3,600 pounds. Size snaphooks to prevent unintentional disengagement. Use only locking-type snaphooks.

Prior to use, inspect positioning device systems for wear, damage or deterioration, and remove defective equipment from service. Use body harnesses only for employee protection, not for hoisting materials.

### Warning-line systems

A warning-line system is a barrier erected on a roof to warn employees they are approaching an unprotected roof side or edge. The system also designates an area in which roofing work may take place without the use of guardrail, body belt or safety net systems to protect employees in the area. Place the warning line on all sides of the roof work area, and erect it not less than 6 feet from the edge.

When using mechanical equipment, place the warning line not less than 6 feet from the edge parallel to the direction the equipment is operating, and not less than 10 feet from the roof edge perpendicular to the direction of travel.

An access path using two warning lines is a good way to connect material-handling, storage and hoisting areas to the work area. When not used, place a rope, wire, chain or other barricade across the point of access, or offset the path so employees cannot walk directly into the work area.

Warning lines should consist of ropes, wires or chains with supporting stanchions. Flagging the rope, wire or chain at 6-foot intervals with high-visibility material adds to its effectiveness. The lowest point of the warning line, including sag, should not be less than 34 inches, and the highest point not more than 39 inches from the walking/working surface.

Stanchions should resist a force of at least 16 pounds applied horizontally against the stanchion, 30 inches above the walking/working surface, perpendicular to the warning line and in the direction of the edge.

The rope, wire or chain should have a minimum tensile strength of 500 pounds and support the loads applied to the stanchions. Attach the line so that when one section is pulled, the adjacent section will not take up the slack. Prohibit employees from the area between the warning line and the roof edge unless they are performing roof work in that area.

Use and store mechanical equipment only in areas where a warning-line system, guardrail system or personal fall-arrest system protects employees.

### Controlled-access zones

A controlled-access zone (CAZ) is an area where certain work may take place without the use of guardrail systems or safety net systems, and access to the zone is controlled. You may use a CAZ in overhand bricklaying, leading edge and precast-concrete erection operations. A controlled-access zone is also referenced in the fall-protection plan.

Where leading edge and other operations are taking place, define the CAZ by a control line that restricts access. Erect control lines at least 6 feet but no more than 25 feet from the unprotected edge.

When erecting precast-concrete members, erect the control line not less than 6 feet but no more than 60 feet or half the length of the member to be erected, whichever is less.

Connect the control line to the guardrail system and run it parallel to the leading-edge work. Limit access to the CAZ to employees involved in overhand bricklaying.

Use ropes, wires, tapes or equivalent materials attached to support stanchions as control lines. Flag each line at 6-foot intervals, and rig them so the lowest point is not less than 39 inches or more than 45 inches (50 inches for overhand bricklaying) from the walking/working surface. Each line should have a minimum breaking strength of 200 pounds.

On walking/working surfaces where overhand bricklaying begins and the guardrail system is not in place, make the CAZ large enough to enclose all points of access, material-handling areas and storage areas.

### Safety monitoring systems

In a safety monitoring system, a competent person is responsible for recognizing fall hazards, and warning employees when they appear to be unaware of a fall hazard or are acting in an unsafe manner. To do this, the person needs to be on the same level, in visual sighting distance and able to communicate orally with employees. The safety monitors should not have responsibilities that take their attention from the monitoring function.

Do not use mechanical equipment on low-sloped roofs where a safety monitoring system is the method of protection. Only employees performing low-sloped roofing work or employees covered by a falling protection plan should be in areas guarded by a safety monitor system. You must direct these employees to comply with the warning from the safety monitors.

You can provide protection from falling objects through several options. When using toeboards, erect them along the edge of the working surface

for a distance sufficient to protect employees below. Make toeboards at least 3.5 inches high and withstand a force of 50 pounds in a downward or outward direction. When tools, equipment or materials are piled higher than the toeboard, use screening or paneling erected from the toeboard to the top of the guardrail system to protect employees below. Ensure openings in screens are small enough to prevent objects from falling.

Make sure canopies used to protect employees from falling objects are strong enough to prevent collapse or penetration by any object falling onto the canopy.

When overhand bricklaying operations are taking place, do not store material or equipment within 4 feet of the working edge. Remove excess mortar, broken masonry units and debris at regular intervals.

During roofing, do not store work materials and equipment within 6 feet of the roof edge unless a guardrail system is installed. Materials piled or stacked near the roof edge should be stable and self-supporting.

### Fall-protection plans

Fall-protection plans are available only for employees engaged in leading-edge work, precast-concrete erection or residential construction. To use this option, the employer must demonstrate that it is infeasible or creates a greater hazard to use conventional fall-protection equipment.

The fall-protection plan should be:

- Prepared by a competent person;
- Specific to the site;
- Maintained up to date;
- Approved by a qualified person if changes are made;
- Maintained at the job site;
- Implemented under the supervision of a competent person;
- Documented as to why conventional fall-protection systems are infeasible or create a greater hazard;
- Provided with a written discussion of measures to reduce or eliminate fall hazards;
- Able to identify location where conventional

fall-protection cannot be used (these locations must be classified as controlled-access zone);

- Noted where no other alternative measures have been implemented and a safety monitoring system must be used;
- Supplied with the names or identification of employees who work in controlled-access zones (no other employees may enter CAZ);
- Able to provide a method to investigate an employee fall or serious incident, changes needed and implementation of those changes.

### Employee training

Design employee training programs so employees who might be exposed to fall hazards can recognize and minimize these hazards. A competent person should conduct training. Ensure he or she is qualified in the:

- Nature of fall hazards;
- Erecting, maintaining, disassembling and inspection of the fall-protection system;
- Use and operation of fall-protection systems;
- Role of employees in a safety monitoring system;
- Use of mechanical equipment during low-sloped roofing work;
- Handling and storage of equipment and material, and erection of overhead protection;
- Role of employees in fall-protection plans;
- Standards contained in subpart M.

The employer prepares a written training record, including names or other identities of employees trained, date, and signature of the person or the company conducting the training. If another employer conducted the training, the record should indicate the date prior training was determined adequate. Keep all training records up to date.

Employees may receive more training when an employer believes previously trained employees do not understand or do not have the skills needed to recognize and minimize these hazards. Retraining also may be in order when changes in the workplace or changes in the fall-protection equipment render previous training obsolete.