FALL PROTECTION/ RESCUE PROGRAM

PURPOSE

Falls hazards exist when work must be performed from elevated surfaces. Fall protection also includes protection from the hazards of falling objects. Observing existing precautions in OSHA's General Industry and Construction Standards can prevent injury and death resulting from falls.

The purpose of this program is to ensure that every employee who works for Winger Companies, herein referred to as Winger, recognizes work place fall hazards and takes the appropriate measures to address those hazards. A fall protection plan shall be prepared by a qualified person for specific work sites as requested.

Accident investigations shall be conducted to evaluate the fall protection plan for potential updates to practices, procedures or training in order to prevent reoccurrence.

HAZARD IDENTIFICATION

As a general rule, a fall hazard exists any time a worker is at a height greater than four (4) feet. Wherever possible, the hazard should be eliminated by using engineering and design controls. If the fall hazard cannot be eliminated, then the use of fall protection equipment must be implemented. In these cases, personnel shall be provided with, and trained to use, the correct personal protective equipment for the elevated work that is to be performed in regards to the following areas:

- Unprotected sides and edges
- Leading edge
- Hoist areas
- Holes, including skylights
- Formwork and reinforcing steel
- Ramps, runways, and other walkways
- Excavations
- Dangerous equipment
- Overhead bricklaying and related work
- Change of elevation
- Roofs, both flat and sloped
- Precast concrete erection
- Wall openings

Employees shall be protected from falling four (4) feet or more, and from tripping on or stepping into or through hazards by using the following:

- Guardrail systems
- Covers, barricades and fences
- Safety net systems
- Personal Fall Arrest Systems (PFAS)
- Positioning device systems
- Warning line systems
- Controlled access zones
- Safety monitoring systems
- Covers

Each employee shall wear a hard hat to protect them from falling objects. Employees shall be protected from falling objects by implementing one of the following measures as appropriate:

- Erect toeboards, hole covers, screens or guardrail systems to keep objects from falling.
- Erect a canopy structure
- Barricade areas to which objects could fall.

FALL PROTECTION SYSTEMS

GUARDRAILS

Guardrails are frequently used to provide fall protection. Make sure that they have been installed properly before working on an elevated surface. Never lean on guardrails or tie-off to guardrails.

The guardrail system must be about 42 inches above the walking/working level. All guardrails must be able to withstand 200 lbs of pressure.

Make sure that the guardrails do not pose additional hazards. Guardrail system surfaces must be smooth to prevent punctures, lacerations, or the snagging of clothing. Edges or connections must not extend into the work area and cause a projection hazard. Steel banding or plastic banding cannot be used for top rails or midrails. If wire rope is used for top rails, place flags every 6 feet.

Hoisting areas and wall/floor openings pose special problems. Make sure that a chain, gate, or removable guardrail is secured when you are not hoisting material. All unprotected sides or edges of an opening must be protected. When holes are used for the passage of materials, not more than two sides of the guardrail system can be removable. When the opening is not being used, place a cover over the opening or replace all sections of the guardrail system. Covers should be marked "HOLE" or "COVER." Openings that are used as a ladder access must have a gate. Make sure the gate is in place when the ladder is not in use.

Remember: A **hole** is a gap or void 2 inches or more in its least dimension in any floor, roof, or other walking and working surface. An **opening** is a gap or void 30 inches or more high and 18 inches or more wide in a wall or partition, through which employees can fall to a lower level.

Guard all holes into which persons can accidentally walk either with a standard railing with standard toe board on all exposed sides or by a hole cover of standard strength and construction that is secured against accidental displacement. Whenever the cover is not in place, protect the floor hole with a standard railing.

Guard all openings, holes, and unprotected sides and edges from which there is a drop of more than 6 feet above lower levels. In general industry the requirement for guarding from falls to lower levels is 4 feet.

Wood, pipe or structural steel can be used for guardrail systems. If wood is used, the specifications listed should be followed. Wood components shall be a minimum 1500 lb-ft/in2 fiber (stress grade) construction grade lumber; the posts shall be at least 2" x 4" (5 cm x 10 cm) lumber spaced not more than 8' (2.4 m) apart on centers; the top rail shall be at least 2" x 4" (5 cm x 10 cm) lumber, the intermediate rail shall be at least 1" x 6" (2.5 cm x 15 cm) lumber. All lumber dimensions are nominal sizes.

If pipe is used, these specifications should be followed. Posts, top rails, and intermediate railings shall be at least one and one-half inches nominal diameter (schedule 40 pipe) with posts spaced not more than 8' (2.4 m) apart on centers.

If structural steel railings are used, these specifications should be followed. Posts, top rails, and intermediate rails shall be at least 2" x 2" (5 cm x 10 cm) by 3/8" (1.1 cm) angles, with posts spaced not more than 8' (2.4 m) apart on centers.

Where doors or gates open directly on a stairway, a platform shall be provided, and the swing of the door shall not reduce the effective width of the platform to less than 20 inches (51 cm).

The specifications given in OSHA 1926.500 - Subpart M are detailed below.

1. Guardrail height shall be 42 inches (± 3 inches) above the walking/working level. The height may be adjusted as needed for conditions. For example, when using stilts, the top must be increased by an amount equal to the height of the stilts.

2. A midrail, screen, mesh or other equivalent intermediate structural member shall be installed when there is no wall or parapet wall at least 21 inches high.

3. Screens and mesh, when used, shall extend from the top rail to the walking/working level.

4. Intermediate members (such as balusters) when used between posts shall not be more then 19 inches apart. (There shall be no openings more than 19 inches wide.)

5. Midrails are to be installed at a height midway between the top edge of the guardrail system and the walking/working surface.

6. Screens, mesh, midrails, etc. shall be capable of withstanding a force of 150 lbs. applied in any outward or downward direction.

7. Guardrail systems shall be constructed to withstand, without failure, a force of a least 200 pounds applied within 2 inches of the top edge in any outward or downward direction.

8. Top rails and midrails shall be at least 1/4 inch nominal diameter or thickness.

9. Steel banding and plastic banding shall not be used.

10. If wire rope is used for top rail, it shall be flagged at no more than 6 foot intervals with high-visibility material.

11. Guardrail systems shall be surfaced to prevent injury from punctures or lacerations and to prevent snagging of clothing.

12. Ends of top rails shall not overhang the terminal posts so as to constitute a projection hazard.

13. At hoisting areas, a chain, gate or removable guardrail section shall be placed across the access opening when hoisting operations are not taking place.

14. Guardrail systems used at openings shall be erected on all unprotected sides or edges of the hole.

15. If the opening is used for passage of materials, no more than two sides may have removable guardrail sections.

16. When not in use, holes shall be covered.

17. Openings used for access (such as ladder ways) shall be provided with a gate or be offset so that a person cannot walk directly into the hole.

18. Guardrail systems on ramps and runways shall be erected along each unprotected side or edge.

19. If manila, plastic or synthetic rope is used for top or midrail it shall be inspected as frequently as necessary to ensure it continues to meet the strength requirements given above.

20. Regardless of height, open-sided floors, walkways, platforms, or runways above or adjacent to dangerous equipment, pickling or galvanizing tanks, degreasing units, and similar hazards shall be guarded with a standard railing and toe board.

21. Every flight of stairs having four or more risers shall be equipped with standard stair railings or standard handrails.

22. A landing extending a minimum of 30 inches in the direction of travel shall be provided for all stairs.

23. A stairway or ladder is needed at all breaks of elevation greater than 19 inches.

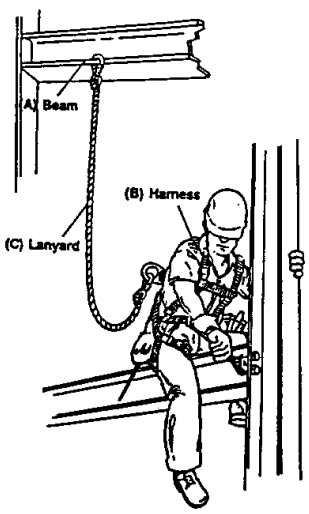
SAFETY NET SYSTEMS

Safety nets may be installed to provide protection from falls. The net will be installed and tested before its use. A 400 lb bag of sand 30" x 2" will be dropped from the highest level from which a fall hazard exists. The net must prevent contact with the surface. Defective nets will be repaired or removed from service. Nets that are repaired or are left in place for more than 6 months must be retested. If tests cannot be performed, a competent person must certify that the net is in compliance. A record of the certification must be available at the jobsite.

Inspect nets weekly for wear, damage, and other deterioration. Remove defective nets from service. Make sure that scrap, tools and other materials that fall into the net are removed as soon as possible.

The net should be as close as possible to the working level. Do not work on levels more than 30 feet above the net. If work must be performed at a higher level, the net must be moved and retested.

PERSONAL FALL ARREST SYSTEM (PFAS)



A PERSONAL FALL ARREST SYSTEM is used to stop an employee from falling more than 6 feet. It consists of an anchorage (A in the illustration), connectors (C in the illustration), a full-body harness (B in the illustration), and may include a lanyard, deceleration device, lifeline, or combinations of these.

1. **Body Wear** – Personal protective gear worn by workers performing the job, usually a full-body harness.

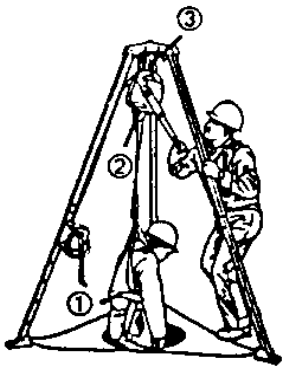
2. **Connecting Devices** – Devices that attach to the workers' protective gear such as shock absorbing lanyards, retractable lifelines & fall limiters, and rope grabs. These devices must limit the free fall distance that a person can fall to ≤ six feet or prevent contact with any lower level.

3. **Anchoring Devices** – A structural support area that supports the entire weight of the system. Commonly called a **tie-off point**, the anchorage must be capable of supporting **5000 pounds per attached worker**. Designed eye bolts, overhead beams, and integral parts of building structures are forms of anchorage points

Full-body harnesses distribute the forces over the thighs, pelvis, waist, chest and shoulders and should be used for fall arrest.

The lanyard is a flexible line of rope, wire rope, or strap, which allows connection of a full-body harness to a deceleration device, lifeline, or anchorage point.

There are two types of lifelines. A vertical lifeline consists of a flexible line for connection to an anchorage at one end to hang vertically. Each employee must have a separate vertical lifeline. A horizontal lifeline connects to anchorages at both ends. It stretches horizontally and serves as an anchorage for other parts of the system.



PERSONAL RETRIEVAL SYSTEM

A PERSONAL RETRIEVAL SYSTEM is mostly used in confined spaces. This system is used primarily where workers must be lowered into tanks, vessels, or manholes and may require retrieval from above in the event of an emergency. Illustrated to the left are the basic components of a personal retrieval system.

1. Full-body harness.

2. Connecting device – retractable lifeline.

3. Attachment point – confined space tripod

FALL PROTECTION SYSTEM REQUIREMENTS

1. Fall protection equipment will meet the requirements of applicable ANSI, ASTM, or OSHA requirements.

2. Only double locking type snap hooks shall be used.

3. The devices used to connect to a horizontal lifeline, which may become a vertical lifeline, shall be capable of locking in both the horizontal and vertical directions of the lifeline.

4. Horizontal lifelines, as part of a complete personal fall arrest system that maintains a safety factor of at least 2, shall be designed, installed, and used under the supervision of a qualified person.

5. Each employee shall be attached to a separate vertical lifeline.

6. Self-retracting lifelines and lanyards shall limit the free fall distance to 2 feet and shall hold 3,000 lbs. or sustain a load of 5,000 lbs.

7. Ropes/Straps (webbing) shall be made from synthetic fibers.

8. Anchors shall have a safety factor of 2 and support 5,000 lbs. per employee.

9. No Personal Fall Arrest System (PFAS) component shall be used to hoist material.

10. PFAS's shall not be attached to guardrail systems or hoists.

11. Lifelines shall be protected against cuts or abrasions.

12. The attachment point of a full-body harness shall be located between the shoulder blades and the base of the head.

13. Personal fall arrest systems and components subjected to impact loading shall be immediately removed from service and shall not be used again for employee protection until inspected by a competent person and determined to be undamaged and suitable for reuse.

14. Personal fall arrest systems shall be inspected prior to each use for wear, damage and deterioration. Defective components shall be removed from service.

15. Lanyards and vertical lifelines shall have a breaking strength of 5,000 lbs.

16. The employer shall provide for prompt rescue of employees in the event of a fall or shall ensure that employees are able to rescue themselves.

17. When stopping a fall, personal fall arrest systems shall:

    - Limit the maximum arresting forces on an employee to 1,800 lbs. when used with a full-body harness.

    - Be rigged so that an employee cannot free fall more than 6 feet or come in contact with any lower level.

    - Bring an employee to a complete stop and limit the maximum deceleration distance an employee travels to 3.5 feet.

    - Withstand twice the impact of 6 foot free fall.

SELECTION AND MAINTENANCE

1. Match personal fall protection system to the particular work situation. Consideration should be given to the particular work environment. For example, the presence of acids, dirt, moisture, oil, grease, etc., and their effect on the system, should be evaluated. Hot or cold environments may also have an adverse effect on the system. Wire rope should not be used where an electrical hazard may be present. Make sure you are aware of rescue procedures if a fall occurs.

2. Protect lanyards, connectors, and lifelines from damage caused by work operations such as welding, chemical cleaning, and sandblasting. Protection from seasonal weather changes must also be considered. Monitor the system's effectiveness. Clean and maintain the system as necessary.

3. Make sure all components are made to work with each other. Not all parts are compatible. Any substitutions or changes to a personal fall arrest system should be fully evaluated or tested by a competent person.

4. Inspect personal fall arrest systems before each use. Check for distorted hooks or faulty hook springs; tongues unfitted to the shoulder of buckles; loose or damaged mountings; non-functioning parts; or wearing or internal deterioration in the ropes. Any component with a significant defect or other wear, such as cuts, tears, abrasions, mold, or undue stretching is defective. Alterations, exposure to fire and/or corrosives, might also affect its ability to provide adequate protection. Tag or mark defective systems as unusable, or destroy them. Personal fall arrest systems that have been subject to an impact from falling must also be removed from service.

5. Use an appropriate anchorage point. One of the most important aspects of personal fall protection systems is anchorage points.

   The following describes anchorage points that may be used if they meet the requirements of the standard. Anchorage points built into the structure may be used during construction, as well as afterwards. A registered professional engineer or other qualified person may install an anchorage point prior to use. In some cases, the anchor point may be existing structures. Steel members or I-beams may be used if an acceptable strap is available for the connection (do not use a lanyard with a snap hook clipped onto itself unless specifically designed for that purpose). Masonry or wood members can only be used if the attachment point is substantial and precautions have been taken to ensure that bolts or other connectors will not pull through. Make sure that you have confirmed the use of all anchor points with a qualified person.

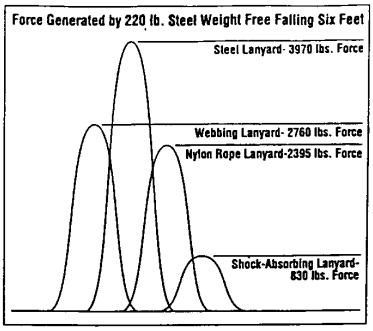
6. Use a tie-off that does not reduce the effectiveness of the system. A knot in a rope lanyard or lifeline can reduce the strength of the system by 50 percent or more. When placed around an "H" or "I" beam its strength may be reduced as much as 70 percent. Compensate for strength reduction or use materials that will provide the proper protection. For example, use a webbing lanyard or wire core lifeline around the beams.

   The angle of attachment to a horizontal lifeline can also reduce the strength of a system. When the angle of horizontal lifeline sag is less than 30 degrees, the impact force on the lifeline by a lanyard is increased greatly. For example, with a sag angle of 15 degrees, the force is about 2:1. At 5 degrees sag, it is about 6:1. Extreme care should be taken in considering a horizontal lifeline for multiple tie-offs. If one employee falls, the movement of the falling employee and the horizontal lifeline may cause other employees to fall. Horizontal lifeline and anchorage strength should be increased for each additional employee to be tied off. The design of systems using horizontal lifelines must only be done by qualified persons.

   The strength of an eyebolt is rated along the axis of the bolt and its strength is greatly reduced if the force is applied at an angle to this axis (in the direction of shear). Also, care should be exercised in selecting the proper diameter of the eye to avoid accidental disengagement of snap-hooks not designed to be compatible for the connection.

   Other factors involved in a proper tie-off are elongation and deceleration distance. During the arresting of a fall, a lanyard will experience a length of stretching or elongation. The additional stopping distance may

be very significant. The location of the tie-off should also consider the hazard of obstructions. Tie-offs that minimize the possibilities of exaggerated swinging should be considered.



If you have any doubts about what fall protection product to use, choose the following basic system. Refer to the comparison chart at the right when choosing the shock-absorbing lanyard.

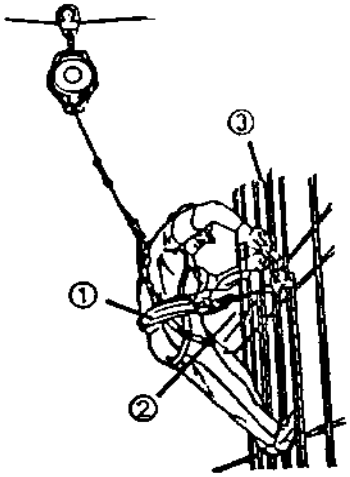
A. Full body harness with sliding back "D"-ring.

B. Shock absorbing lanyard with locking snaps.

C. Reliable anchorage tie-off points.

POSITIONING DEVICE SYSTEM

A POSITIONING DEVICE SYSTEM is a full-body harness rigged to support an employee while working on a vertical surface, such as a wall. OSHA defines a positioning system as a system of equipment or hardware which, when used with its full-body harness, allows a worker to be supported on an elevated vertical surface and work with both hands free. It consists of the same basic components as a fall arrest system. However, it must limit free fall distance to two feet. Positioning devices shall be secured to an anchorage capable of supporting at least twice the potential impact load of an employee's fall or 3,000 pounds, whichever is greater. Neither personal fall arrest systems, nor positioning devices, may be used for hoisting materials.



A combination fall arrest/positioning system must be used if at all possible. However, in some cases, an additional fall arrest system is not practical. For example, a worker installing beams, columns, or piping may have no overhead anchor points available. Illustrated to the right is an example of a widely used positioning system.

WARNING LINE SYSTEM

1. The warning line shall be erected around all sides of the roof work area and not less than 6 feet from the roof edge.

2. When mechanical equipment is being used, the warning line shall be erected not less than 6 feet from the roof edge which is parallel to the direction of mechanical equipment operation and not less than 10 feet from the roof edge which is perpendicular to the direction of mechanical equipment operation.

3. Warning lines shall consist of ropes, wires or chains and supporting stanchions and flagged at no more than 6-foot intervals with high-visibility material.

4. The warning line shall be rigged and supported in such a way that its lowest point (including sag) is no less than 34 inches and no more than 39 inches from the walking/working surface.

5. Mechanical equipment on roofs shall be used or stored only in areas where employees are protected by a warning line system, guardrail system or personal fall arrest system.

CONTROLLED ACCESS ZONE (CAZ)

Controlled access zones are areas in which certain work (e.g., overhand bricklaying) may take place without the use of guardrail systems, personal fall arrest systems, or safety net systems and access to the zone is controlled. A control line or other means that restricts access shall define the controlled access zone. The line will be set up between 6 feet and 25 feet from the unprotected or leading edge. If precast concrete members are being erected, the control line may be between 6 feet and 60 feet or half the length of the member being erected. The control line will be set up parallel along the entire length of the unprotected or leading edge. It will be connected on each side to a guardrail system or wall.

For jobs that involve overhand bricklaying and related work, a control line erected between 10 feet and 15 feet from the working edge will define the controlled access zone. The control line must be setup to enclose all employees performing overhand bricklaying and related work at the working edge. Additional control lines will be erected at each end to enclose the controlled access zone.

Do not enter the controlled access zone without prior authorization and unless required to perform work in that area.

The specifications given in OSHA 1926.500 - Subpart M are detailed below.

1. When used to control access to areas where leading edge and other operations are taking place, the controlled access zone shall be defined by a control line or by any other means that restricts access.

2. Control lines shall consist of ropes, wires, tapes or equivalent materials and supporting stanchions with each line flagged or clearly marked at no more than 6-foot intervals with high-visibility materials.

3. Control lines shall be connected on each side to a guardrail system or wall.

4. The control line shall extend along the entire length and approximately parallel to the unprotected or leading edge.

SAFETY MONITORING SYSTEMS

In order to perform some operations, the usual methods for providing fall protection (guardrails, safety nets, etc.) are not possible. This may occur when work involves leading edge work, precast concrete erection work, overhand bricklaying or related work. During these operations, controlled access zones and a safety monitoring system will be established. A Fall Protection Plan will be established for each jobsite where these types of fall protection are used. The plan will be reviewed with all affected employees before work begins.

A safety-monitoring system requires that a competent person is responsible for recognizing and warning employees of fall hazards. The competent person designated will monitor the safety of employees working in areas where fall hazards are present. Do not ask the safety monitor to perform other duties. They must be on the same walking/working surface and be within visual sighting distance of all employees being monitored. In addition, they must be able to communicate orally with all employees being monitored.

When safety-monitoring systems are used, other precautions must be followed.

1. Do not store or use mechanical equipment in areas where safety-monitoring systems are being used to monitor employees engaged in roofing operations on low-slope roofs.

2. Do not enter areas where other employees are engaged in roofing work on low-sloped roofs, covered by a fall protection plan, or being protected by a safety monitoring system.

3. Remember: All employees must follow the instructions of the safety monitor.

COVERS

1. Covers for holes in roofs, floors and other walking/working surfaces shall be capable of supporting without failure, at least twice the weight of employees, equipment and materials that may be imposed on the cover at any time.

2. All covers shall be **secured** to prevent accidental displacement by wind, equipment or employees.

3. All covers shall be color coded or marked with the word "**HOLE**" or "**COVER**" to provide warning of the hazard.

PROTECTION FROM FALLING OBJECTS

1. Toe boards, when used as falling object protection, shall be erected along the edge of the overhead walking/working surface for a distance sufficient to protect employees below.

2. Toe boards shall be a minimum of 4 inches high and shall not have more than 1/4 inch of clearance above the walking/working surface. Toe boards shall be solid or have openings not over 1 inch in greatest dimension.

3. Canopies, when used as falling object protection, shall be strong enough to prevent collapse or penetration by any object that may fall on the canopy.

REASONS PEOPLE GET HURT

There are 3 reasons why people fall and get injured when working while elevated:

- Lack of training
- Employees not inspecting their equipment
- Improper use of equipment

"Don't just tie-off to be compliant, tie-off to prevent injuries."

FALL RESCUE PLANS

The purpose of this section is to ensure that every employee who works for Winger recognizes work place fall hazards and takes the appropriate measures to address those hazards. Supervisors and foremen must ensure trained employees are using proper fall protection arrest systems, ladders, scaffolds and aerial lifts to perform their work tasks safely and efficiently. This section has been developed in the event an employee falls and immediate rescue is warranted.

BACKGROUND

It was reported that of the 10 mountain climbers in Austria who became trapped in a suspended position before rescue for durations ranging from 30 minutes to eight hours, two expired pre-rescue, three died almost immediately after rescue and five died over the course of the ensuing 11 days.

Orthostatic intolerance may be defined as "the development of symptoms such as light-headedness, palpitations, tremulousness, poor concentration, fatigue, nausea, dizziness, headache, sweating, weakness and occasionally fainting during upright standing". While in a sedentary position, blood can accumulate in the veins, which is commonly called "venous pooling," and cause orthostatic intolerance. Orthostatic intolerance also can occur when an individual moves suddenly, after being sedentary for a long time. For example, a person may experience orthostatic intolerance when they stand up quickly after sitting still for a long time.

A well-known example of orthostatic intolerance is that of a soldier who faints while standing at attention for long period of time. The moment the soldier loses consciousness, he or she collapses into a horizontal position. With the legs, heart, and brain on the same level, blood is returned to the heart. Assuming no injuries are caused during the collapse, the individual will quickly regain consciousness and recovery is likely to be rapid.

Venous pooling typically occurs in the legs due to the force of gravity and a lack of movement. Some venous pooling occurs naturally when a person is standing. In the veins, blood normally is moved back to the heart through one-way valves using the normal muscular action associated with limb movement. If the legs are immobile, then these "muscle pumps" do not operate effectively, and blood can accumulate. Since veins can expand, a large volume of blood may accumulate in the veins.

An accumulation of blood in the legs reduces the amount of blood in circulation. The body reacts to this reduction by speeding up the heart rate and in an attempt to maintain sufficient blood flow to the brain. If the blood supply is significantly reduced, this reaction will not be effective. The body will abruptly slow the heart rate and blood pressure will diminish in the arteries. During severe venous pooling, the reduction in quantity and/or quality (oxygen content) of blood flowing to the brain causes fainting. This reduction also can have an effect on other vital organs, such as the kidneys. The kidneys are very sensitive to blood oxygen, and renal failure can occur with excessive venous pooling. If these conditions continue, they potentially may be fatal.

HARNESS INDUCED DEATH / SUSPENSION TRAUMA

Wide ranges of situations require safety harnesses of various types. Workers requiring fall protection, workers entering many confined spaces, mountain climbers, deer hunters in elevated stands, and cave explorers all try to protect themselves through the use of safety harnesses. What is little known, however, is that these harnesses can also kill. Harnesses can become deadly whenever a worker is suspended for durations over five minutes in an upright posture, with the legs relaxed straight beneath the body.

SIGNS & SYMPTOMS

Orthostatic intolerance may be experienced by workers using fall arrest systems. Following a fall, a worker may remain suspended in a harness. The sustained immobility may lead to a state of unconsciousness. Depending on the length of time the suspended worker is unconscious/immobile and the level of venous pooling, the resulting orthostatic intolerance may lead to death. While not common, such fatalities often are referred to as "harness-induced pathology" or "suspension trauma."

Signs & symptoms that may be observed in an individual who is approaching orthostatic intolerance:	
Faintness	Nausea
Breathlessness	Dizziness
Sweating	Unusually Low Heart Rate
Paleness	Unusually Low Blood Pressure

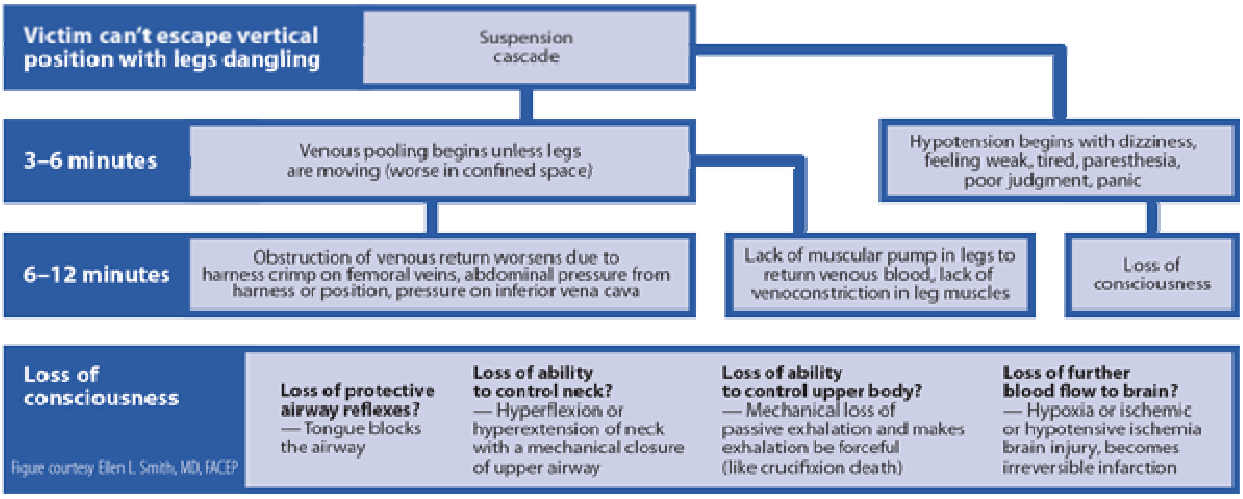
Hot Flashes	"Greying" or Loss of Vision
Increased Heart Rate	◆

Factors that can affect the degree of risk of suspension trauma:	
Inability to move legs	Hypothermia
Pain	Shock
Injuries during fall	Cardiovascular disease
Fatigue	Respiratory disease
Dehydration	Blood loss

Unconscious/immobile workers suspended in their harness will not be able to move their legs and will not fall into a horizontal position, as they would if they fainted while standing. During the static upright position, venous pooling is likely to occur and cause orthostatic intolerance, especially if the suspended worker is left in place for some time. Venous pooling and orthostatic intolerance can be exacerbated by other circumstances related to the fall. For example, shock or the experience of the event that caused the fall, other injuries, the fit/ positioning of the harness, the environmental conditions, and the worker's psychological state all may increase the onset and severity of the pooling and orthostatic intolerance. Unless the worker is rescued promptly using established safe procedures, venous pooling and orthostatic intolerance could result in serious or fatal injury, as the brain, kidneys, and other organs are deprived of oxygen.

The amount of time spent in this position, with the legs below the heart, affects the manner in which the worker should be rescued. Moving the worker quickly into a horizontal position - a natural reaction - is likely to cause a large volume of deoxygenated blood to move to the heart, if the worker had been suspended for an extended period. The heart may be unable to cope with the abrupt increase in blood flow, causing cardiac arrest. Rescue procedures must take this into account. Recommended rescue procedures are outlined below in the Conclusions and Recommendations section.

Figure 1: Rapid cascade of events during suspension trauma



RECOMMENDATIONS

Prolonged suspension from fall arrest systems can cause orthostatic intolerance, which, in turn, can result in serious physical injury, or potentially, death. Research indicates that suspension in a fall arrest device can result in unconsciousness, followed by death, in less than 30 minutes. To reduce the risk associated with prolonged suspension in fall arrest systems, employers should implement plans to prevent prolonged suspension in fall protection devices. The plan should include procedures for: preventing prolonged suspension, identifying orthostatic intolerance signs and symptoms, and performing rescue and treatment as quickly as possible.

OSHA recommends the following general practices/considerations:

- Rescue suspended workers as quickly as possible.
- Be aware that suspended workers are at risk of orthostatic intolerance and suspension trauma.
- Be aware of signs and symptoms of orthostatic intolerance.
  - Faintness
  - Nausea
  - Breathlessness
  - Dizziness
  - Sweating
  - Unusually low heart rate or unusually low blood pressure
  - Increased heart rate
  - Paleness
  - Hot flashes
  - "Graying"
  - Loss of vision
- Be aware that orthostatic intolerance is potentially life threatening. Suspended workers with head injuries or who are unconscious are particularly at risk.
- Be aware of factors that can increase the risk of suspension trauma.
- Be aware that some authorities advise against moving the rescued workers to a horizontal position too quickly.

SUSPENSION TRAUMA STRAPS

The Suspension Trauma Safety Strap was designed to help a worker overcome the potential negative health impacts of suspension trauma (otherwise known as Orthostatic Intolerance). This condition can occur when a person remains suspended at height (after a fall) for even short periods of time. Suspension in a harness may cause blood to pool in the veins of the legs which can result in unconsciousness; if not rescued promptly, serious injury or death may occur. OSHA requires that employers provide for prompt rescue of employees in the event of a fall. The Suspension Trauma Safety Strap is designed to prevent suspension trauma while a worker is awaiting rescue.

SAFETY STRAP HELPS PREVENT SUSPENSION TRAUMA

The Suspension Trauma Safety Strap allows the worker, who is suspended, to stand up in their harness and to relieve the pressure being applied to the arteries and veins around the top of the legs. The continuous loop design allows both sides of the harness to relieve the pressure being applied to the legs. The strap accommodates either having one foot or both feet in the loop at a time - it will relieve the pressure to both sides with just one foot in

allowing for added movement of the legs. The strap allows for increased comfort, balance and improved circulation in the legs while suspended and waiting for rescue.

FAST AND EASY INSTALLATION, OPERATION

The two packs are compact, lightweight and easily installed to most harness sizes, styles and brands. To attach, simply choke the pack around the harness web at the hip. After a fall, the packs can quickly be unzipped, deploying the web loop and hook straps. These are easily connected and adjusted to provide a strap for the foot to conveniently step into. This allows the worker to stand in their harness and relieve the pressure on the legs while waiting for rescue.

FEATURES:

- Suspension Trauma Safety Strap: helps prevent the effects of suspension trauma after a fall
- Allows worker who is suspended: to stand up in their harness to relieve pressure
- A safety accessory: that can be attached to most harness brands/styles right in the field
- Installation to your harness is fast and efficient: - just choke off to strap and it's ready
- Extremely compact and lightweight design: stays out of the worker's way
- Deployment and operation: is fool-proof, simply unzip, and hook straps together
- Continuous loop design: allows for either one or two-foot suspension relief without pinching

JOB SAFETY ANALYSIS

A Job Safety Analysis should be performed before projects begin to prevent employees from falling. Always use ladders, scaffolds, and aerial lifts if possible. Foremen should schedule jobs to have two or more workers at the same site location. In case, one worker does get suspended the other employee will be there for rescue. The best way to prevent orthostatic intolerance is to take every possible precaution to prevent the fall in the first place.

Before the potential fall:

Workers should never be permitted to work alone in a harness.

Rope/cable tenders must make *certain* the harness user is conscious at all times.

1. Time in suspension should be limited to under five minutes. Longer suspensions must have foothold straps or means for putting weight on the legs.

2. Harnesses should be selected for specific applications and must consider: compliance (convenience), potential arrest injury, and suspension trauma.

3. Tie-off lanyards should be anchored as high and tight as work permits.

After a fall:

1. Workers should be trained to try to move their legs in the harness and try to push against any footholds. Fall victims can slow the onset of suspension trauma by pushing down vigorously with the legs, by positioning their body in a horizontal or slight leg-high position, or by standing up. Overexerting however, can make the victim over-fatigued and faint more rapidly.

2. Workers should be trained in the safe use of suspension trauma straps to relieve the effects of suspension trauma.

3. Workers hanging in a harness should be trained to try to get their legs as high as possible and their heads as close to horizontal as possible (this is nearly impossible with many commercial harnesses in use today).

4. It the worker is suspended upright, emergency measures must be taken to remove the worker from suspension or move the fallen worker into a horizontal posture, or at least to a sitting position.

5. All personnel should be trained that suspension in an upright condition for longer than five minutes can be fatal.

For harness rescues:

1. The victim should not be suspended in a vertical (upright) posture with the legs dangling straight. Victims should be kept as nearly horizontal as possible, or at least in a sitting position.

2. Rescuers should be trained that victims who are suspended vertically before rescue are in a potentially fatal situation.

3. Rescuers must be aware that post-rescue death may occur if victims are moved to a horizontal position too rapidly.

RESCUE PROCEDURES

Under 29 CFR 1926.502 (d) (Fall Protection Systems Criteria and Practices), OSHA requires that employers provide for "prompt rescue of employees in the event of a fall or shall assure that employees are able to rescue themselves." This should include identifying rescue procedures that address the potential for orthostatic intolerance and suspension trauma. Rescue procedures also should address how the rescued worker will be handled to avoid any post-rescue injuries.

Rescue procedures should include the following contingency based actions:

- If self-rescue is impossible, or if rescue cannot be performed promptly, the worker should be trained to "pump" his/her legs frequently to activate the muscles and reduce the risk of venous pooling. Footholds can be used to alleviate pressure, delay symptoms, and provide support for "muscle pumping."

- Continuous monitoring of the suspended worker for signs and symptoms of orthostatic intolerance and suspension trauma.

- Ensuring that a worker receives standard trauma resuscitation once rescued. Some authorities recommend that the patient be transported with the upper body raised.

- If the worker is unconscious, keeping the worker's air passages open and obtain first aid.

- Monitoring the worker after rescue, and ensuring that the worker is evaluated by a health-care professional. The worker should be hospitalized when appropriate. Possible delayed effects, such as kidney failure, which is not unusual in these cases, are difficult to assess on the scene.

FIRST AID TREATMENT

If a worker is suspended long enough to lose consciousness, rescue personnel must be careful in handling such a person or the rescued worker my die anyway. This post-rescue death is apparently caused by the heart's inability to tolerate the abrupt increase in blood flow to the right heart after removal from the harness. Not all rescue personnel are trained in orthostatic intolerance and will try to lay the victim in a horizontal position immediately. Recommended procedures in 2007 were to take from 30 to 40 minutes to move the victim from kneeling to a sitting to a supine position.

New guidelines in 2015 suggest that once the victim is on a safe location with no capacity to fall, if the patient is conscious they should be encouraged to vigorously move their legs. Footholds or resting the feet against an adjoining structure can mitigate symptoms and provide the patient intermittent relief.

Until recently, studies suggested keeping the recovered unconscious patient in a semi-recumbent or even seated position to mitigate the flood of fluid and toxins into the heart that was hypothesized was the cause of death for the majority of victims. One treatment suggested keeping the victim in a seated position for at least 30 minutes.

One recommendation is to keep the unconscious patient in the semi-Fowler's position of keeping the upper body at a 30–40-degree angle, then slowly bringing them to a fully supine position in 30–45 minutes. Another is more specific, recommending that the conscious patient should be kept in a seated position for at least 45 minutes but a semi- or unconscious victim should be put in the supine position to return blood flow to the brain.

Recent findings, however, contradict this as others see no reason to differentiate between levels of consciousness and what position to place the body in, advocating immediate supine positioning of the victim, asserting the cause of death is typically secondary to hypoxia and hyperkalemia, so rushing to keep the victim in a seated position is irrelevant.

- There is no scientific evidence of reflow syndrome/rescue death
- There is no international consensus on the correct positioning for patients rescued from suspension
- There is no evidence to suggest that lying a patient down increases the risk of death after rescue from suspension

The most important thing to provide is quick first aid response, the assessment of airway, cardiac status and appropriate lifesaving measures, CPR, if indicated. On the safe side, if a worker has been suspended for longer than 5 minutes or more they should be evaluated by medical professionals.

FALL PROTECTION TRAINING

OSHA requires employers to train any employee who is exposed to a fall hazard, who uses fall protection and arrest systems and other personal protective equipment correctly while performing their jobs, in accordance with OSHA General Industry Regulations and Standards Subpart D Walking Working Surfaces 29 CFR §1910.30 and Subpart I Personal Protective Equipment 29 CFR §1910.132, and OSHA Construction Industry Regulations Subpart M Fall Protection 29 CFR §1926.503. Each employee must be trained by a qualified person. Information and training to each employee must be presented in a manner that the employee understands.

§1910.30 Employees must be trained on the following:

(1) The employer shall provide a training program for each employee who might be exposed to fall hazards. The program shall enable each employee to recognize the hazards of falling and shall train each employee in the procedures to be followed in order to minimize these hazards.

(2) The employer shall assure that each employee has been trained, as necessary, by a competent person qualified in the following areas:

(i) The nature of fall hazards in the work area;

(ii) Procedures to be followed to minimize those hazards;

(iii) The correct procedures for installing, inspecting, operating, maintaining, and disassembling the personal fall protection systems that the employee uses;

(iv) The use and operation of guardrail systems, personal fall arrest systems, safety net systems, warning line systems, safety monitoring systems, controlled access zones, and other protection to be used;

(v) The proper care, inspection, storage, and use of equipment before an employee uses the equipment;

(vi) Each employee who uses a dock-board must be trained on how to properly place and secure it, to prevent unintentional movement;

(vii) Employees who use rope descent systems must be trained in proper rigging and use of the equipment.

(viii) Employees who use a designated area must be trained how to properly set it up and use of the area.

In addition, §1926.503 training provisions supplement and clarify the requirements of §1926.21 regarding the hazards addressed in Subpart M of this part:

- The role of each employee in the safety monitoring system when this system is used;
- The limitations on the use of mechanical equipment during the performance of roofing work on low-sloped roofs;
- The correct procedures for the handling and storage of equipment and materials and the erection of overhead protection; and
- The role of employees in fall protection plans;
- The standards contained in this subpart.

Workers, who wear fall arrest devices while working, and those who may perform rescue activities, should also be trained in:

- How to ascertain whether their personal protective equipment is properly fitted and worn, so that it performs as intended;
- How orthostatic intolerance/suspension trauma may occur;

- The factors that may increase a worker's risk;
- How to recognize the signs and symptoms identified; and
- The appropriate rescue procedures and methods to diminish risk while suspended.

All employees who have a need to wear fall protection equipment will be trained to:

- Identify the nature of fall hazards in the workplace.
- Select the proper equipment for the task to be performed and to wear it properly.
- Understand and identify anchor points.
- The correct procedures for erecting, maintaining, disassembling, and inspecting the fall protection systems to be used.
- The use and operation of guardrail systems, personal fall arrest systems, safety net systems, warning line systems, safety monitoring systems, controlled access zones, and other protection to be used.
- Utilize proper tie-off procedures.
- Learn proper equipment inspection, storage, and maintaining practices.
- Learn proper rescue procedures.
- The role of employees in fall protection plans.
- Training documentation will be kept in the employee's safety training file.

CERTIFICATION OF TRAINING

(1) The employer shall verify compliance with paragraph (a) of this section by preparing a written certification record. The written certification record shall contain the name or other identity of the employee trained, the date(s) of the training, and the signature of the person who conducted the training or the signature of the employer. If the employer relies on training conducted by another employer or completed prior to the effective date of this section, the certification record shall indicate the date the employer determined the prior training was adequate rather than the date of actual training.

(2) The latest training certification shall be maintained.

RETRAINING IS REQUIRED

When the employer has reason to believe that any affected employee who has already been trained does not have the understanding and skill required by paragraph (a) of this section, the employer shall retrain each such employee. Circumstances where retraining is required include, but are not limited to, situations where:

(1) When changes in the workplace render previous training obsolete or inadequate; or

(2) When changes in the types of fall protection systems or equipment to be used render previous training obsolete or inadequate; or

(3) When inadequacies in an affected employee's knowledge or use of fall protection systems or equipment indicate that the employee has not retained the requisite understanding or skill necessary to use the equipment or perform the job safely.

FALL PROTECTION PLAN REVISION

In the event an employee falls, or some other related, serious incident occurs, (e.g., a near miss) Winger shall investigate the circumstances of the fall or other incident to determine if the fall protection plan needs to be changed (e.g. new practices, procedures, or training) and shall implement those changes to prevent similar types of falls or incidents.

ELEVATED SURFACE WORK PLAN

Project Name _____ Project Location _____

Project Supervisor _____ Date _____

Questions to Consider	Answers or Solutions
Does my job hazard analysis address this type of work involving unprotected elevated locations?	
What is the job to be done/	
What's the location?	
How high is it?	
What is the working or walking surface like?	
Are there any environmental factors to consider? (heat, cold, slippery, wet, wind, glare, etc.)	
Are there any hazards nearby or underneath that are exposed or could become exposed in an impact (plumbing lines, electrical exposures, protruding or impalement hazards, etc.)?	
Will the work require special PPE (besides fall protection)?	
Who will I be working with (buddy system)?	
How will I get equipment and tools to the work location?	
Do I need to prevent my activities from resulting in hazards to those below by following appropriate barricading methods to keep non-essential personnel away?	
Can I work from the ground level instead by bringing the work down?	
Can I work safely from a ladder instead?	
Can I use an aerial (boom) lift or scissors lift instead (and am I qualified to operate one?)	
If not, can we install portable guardrails for the job?	
If not, can I use fall restraint?	
If not, will I use fall arrest?	If yes, see following pages for Fall Hazard Analysis for Fall Arrest and Rescue Plan
Other?	

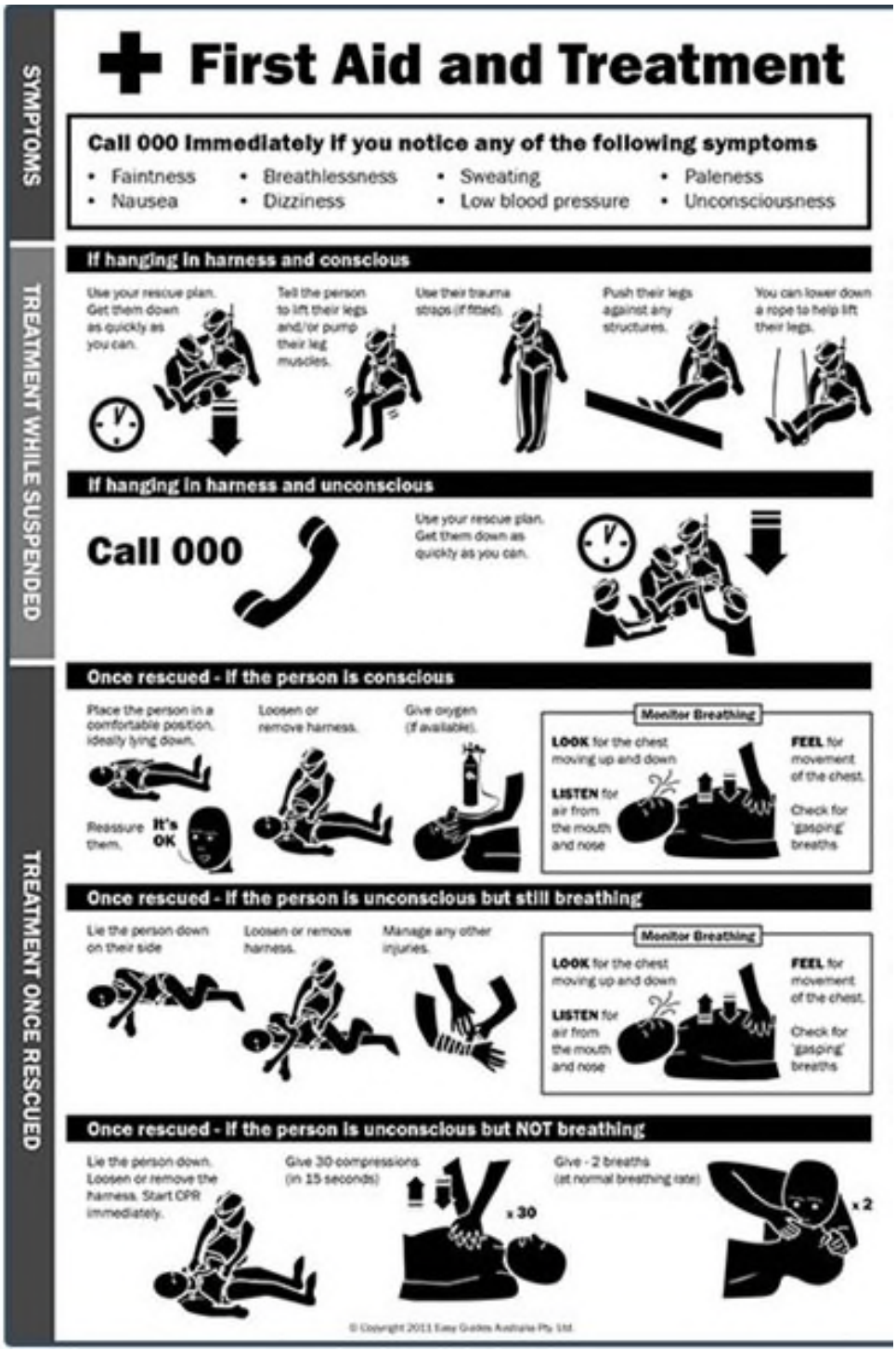
FALL HAZARD ANALYSIS FOR FALL ARREST

Questions to Consider	Answers or Solutions
Are there any existing approved anchorage points I can use? Where?	
Is it labeled as an approved anchorage point or obviously capable of holding 5,000 lbs or more as determined by a designated qualified person?	
If not, can approved pre-manufactured or engineered anchorages be installed?	
Do I have the right equipment (full body harness, minimum length lanyard, shock absorber, connecting hardware, I-beam strap, self-retracting lifeline, etc.)?	
What is the clearance or distance I may fall into?	
Is there at least 15 - 18 feet of clear space from anchorage point before the next level down? (Calculate fall distance to include lanyard length, deceleration distance of 3.5 feet, your height, one foot of harness slack, elongation factor, and a safety factor).	
What is between me and the ground or floor below?	
What will I hit on the way down?	
How would I be rescued if I fall and am suspended in the harness? (Develop rescue plan)	
Other Comments:	

RESCUE PLAN

A rescue plan must be developed whenever fall arrest systems are in use and when personnel may not be able to self-rescue should a fall occur.

Questions to Consider	Answers or Solutions
What is the emergency contact information of professional rescue services available, such as the local Fire Department, and what are the instructions for summoning immediate assistance?	
Is rescue equipment immediately available for this location? (Ladders, aerial devices, elevating work platforms, tripods, additional harnesses, controlled descent devices, winches, pulleys, etc.)	
What obstructions are in the way reaching the suspended worker?	
How will rescue be assured within 15 minutes of the occurrence of a fall to minimize the risk of further injury or death due to suspension trauma?	
How will the safety of the rescuers be assured as well as that of the suspended worker?	
What communication systems will be used between the suspended worker and rescue team?	
Other Comments:	


First Aid and Treatment
SYMPTOMS
Call 000 Immediately if you notice any of the following symptoms
• Faintness
• Nausea
• Breathlessness
• Dizziness
• Sweating
• Low blood pressure
• Paleness
• Unconsciousness
TREATMENT WHILE SUSPENDED
If hanging in harness and conscious
Use your rescue plan. Get them down as quickly as you can.
Tell the person to lift their legs and/or pump their leg muscles.
Use their trauma straps (if fitted).
Push their legs against any structures.
You can lower down a rope to help lift their legs.
If hanging in harness and unconscious
Call 000
Use your rescue plan. Get them down as quickly as you can.
TREATMENT ONCE RESCUED
Once rescued - If the person is conscious
Place the person in a comfortable position, ideally lying down.
Reassure them.
It's OK
Loosen or remove harness.
Give oxygen (if available).
Monitor Breathing
LOOK for the chest moving up and down
LISTEN for air from the mouth and nose
FEEL for movement of the chest.
Check for 'gasping' breaths
Once rescued - If the person is unconscious but still breathing
Lie the person down on their side
Loosen or remove harness.
Manage any other injuries.
Monitor Breathing
LOOK for the chest moving up and down
LISTEN for air from the mouth and nose
FEEL for movement of the chest.
Check for 'gasping' breaths
Once rescued - If the person is unconscious but NOT breathing
Lie the person down. Loosen or remove the harness. Start CPR immediately.
Give 30 compressions (in 15 seconds)
x 30
Give - 2 breaths (at normal breathing rate)
x 2
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