

Marshall Municipal Utilities
FALL PROTECTION
Effective April 1, 2011

PURPOSE

Marshall Municipal Utilities fall protection policy is designed to eliminate and/or control the recognized hazards associated with falls; as well as to ensure all the required procedures are applied to protect employees exposed to a fall due to holes and floor and wall openings.

FALL PROTECTION REQUIREMENT GUIDELINES

All MMU employees shall comply with the standard requirements set forth by both this policy, and the regulations established by United States regulatory agencies. Each employee on a walking/working surface (horizontal and vertical surface) which is 4 feet or more above a lower level shall be protected from falling by the use of a guard rail system or personal fall arrest systems.

GUARDRAIL SYSTEMS

1. Top rails, or equivalent guardrail system members, shall be installed 42 inches nominal above the walking/working level.
2. Midrails, intermediate vertical members, or equivalent intermediate structural members shall be installed at 21 inches nominal between the top guardrail and the walking/working surface, when there is no wall or parapet wall.
 - a. Screens and mesh, when used, shall extend from the top rail to the walking/working level and along the entire opening between top rail supports.
 - b. Intermediate vertical members (such as balusters), when used between posts, shall not be more than 19 inches apart.
 - c. Other structural members (such as additional midrails and architectural panels) shall be installed such that there are no openings in the guardrail system that are more than 19 inches wide.
3. Toeboards shall be installed 4 inches nominal in vertical height from its top edge to the walking/working level. Toeboards shall be provided on every exposed side where, beneath the open sides, persons can pass; there is moving machinery; or there is equipment, machine parts, chemicals, tools, etc., with which falling materials could create a hazard.
4. Guardrail systems shall be so surfaced as to prevent injury to an employee from punctures or lacerations, and to prevent snagging of clothing. The ends of all top rails and midrails shall not overhang the terminal posts, except where such overhang does not constitute a projection hazard.
5. Guardrail systems shall be erected along each unprotected side or edge on every walkway, platform, ramp, and/or runway. When guardrail systems are used at holes, they shall be erected on all unprotected sides or edges of the hole.
6. Guardrail systems shall be installed at hoisting areas. A chain, gate or removable guardrail section shall be placed across the access opening between guardrail sections when hoisting operations are not taking place.

7. Guardrail systems shall be utilized around holes used for the passage of materials. The hole shall have not more than two sides equipped with removable guardrail sections to allow the passage of materials. When the hole is not in use, it shall be closed over with a cover, or a guardrail system shall be provided along all unprotected sides or edges.
8. When covers are removed from points of access or enclosed spaces (such as, but not limited to, manholes) the opening shall be promptly guarded by a railing system, temporary cover, or other barrier intended to prevent an accidental fall through the opening; and, to protect employees working the space from objects entering the space.
9. Guardrail systems shall be utilized at openings of access/egress areas (such as ladder ways). They shall be provided a gate, or be so offset that a person cannot walk directly into the opening.
10. Top rails and midrails shall be at least one-quarter inch nominal diameter or thickness to prevent cuts and lacerations. If wire rope is used for top rails, it shall be flagged at not more than 6-foot intervals with high visibility material.

STAIRWAY AND HANDRAIL SYSTEMS

1. Stairway railing systems shall meet the same construction and testing requirements as a guardrail system, except:
 - a. Top rails shall be installed no more than 34 inches and no less than 30 inches above the surface at the front of the riser (step).
 - b. Midrails shall be installed at a height halfway between the top rail and the surface at the front of the riser, when there is no wall or parapet wall.
2. Handrails shall consist of a lengthwise member mounted directly on a wall, or partition, by brackets attached on the lower side of the handrail that present no obstruction along the top and both sides of the handrail.
 - a. Handrails shall be installed no more than 34 inches and no less than 30 inches above the walking/working level; or above the surface at the front of the riser (step).
 - b. Handrails shall be so surfaced as to provide an adequate handhold for anyone grasping it to avoid slipping and/or falling. The ends of handrails shall be turned in to the supporting wall, or otherwise arranged, to not produce a projection hazard.
 - c. Handrails shall be provided with a clearance of 3 inches or more from any other object.
3. Stairways having four or more risers shall have a minimum width of 22 inches, and shall be equipped a standard stair rail system along each unprotected side or exposed edge.
 - a. Stairways less than 44 inches wide and fully enclosed shall be equipped with at least one handrail, on the right side descending.
 - b. Stairways greater than 44 inches wide but less than 88 inches wide, handrails shall be provided on each enclosed side.
 - c. Stairways 88 inches wide or greater shall be equipped with a handrail on each enclosed side, and one stairway railing system located approximately midway of the stairway width.

MATERIAL REQUIREMENTS FOR GUARDRAIL, HANDRAIL AND STAIRWAY RAILING SYSTEMS:

1. For wood railings: the posts shall be of at least 2-inch by 4-inch stock spaced not more than 6 feet apart on centers; the top and intermediate rails shall be of at least 2-inch by 4-inch stock. If the top rail is made of two right-angle pieces of 1-inch by 4-inch stock, posts may be spaced on 8-foot centers, with 2-inch by 4-inch midrails.
2. For pipe railings: Posts, top rails, and intermediate railings shall be at least 1½-inches nominal diameter with posts spaced not more than 8 feet apart on centers.
3. For structural steel railings: Posts, top rails, and intermediate railings shall be at least 2-inch by 2-inch by 3/8-inch angles, or other metal shapes of equivalent bending strength, with posts spaced not more than 8 feet apart on centers.
4. Steel banding and plastic banding shall not be used as top rails or midrails.

TESTING REQUIREMENTS FOR GUARDRAIL, HANDRAIL AND STAIRWAY RAILING SYSTEMS:

1. Top rails shall be capable of withstanding, without failure, a force of at least 200 pounds applied within 2 inches of the top edge, in any outward or downward direction, at any point along the top edge. When the 200 pound test load specified is applied in a downward direction, the top edge of the guardrail shall not deflect to a height less than 39 inches above the walking/working level.
2. Mid-rails, screens, mesh, intermediate vertical members, solid panels, and equivalent structural members shall be capable of withstanding, without failure, a force of at least 150 pounds applied in any downward or outward direction at any point along the midrail or other member.
3. Toeboards shall be capable of withstanding, without failure, a force of at least 50 pounds applied in any downward or outward direction at any point along the toeboard.

PERSONAL FALL ARREST SYSTEMS

1. Description of components:
 - a. Full body harness - A device worn around the legs, waist, and shoulders, which connects the body to other life-support systems. It has one back D-ring between the shoulders for connection to a lanyard or self-retracting lifeline. A chest D-ring may be used for additional support during vertical access and egress into a lower space or area. The two front D-rings located at the hips are for positioning only.
 - b. Lanyard/Self-Retracting Lifeline (SRL) – The trail line, which connects the harness to the lifeline or anchorage point. Normally, it will have one or more lockable snaps or hooks on each end. **Only one snap hook / connector is allowed to be connected to the back D-ring.**
 - c. Anchorage Point – Completes the personal fall arrest system. It is normally attached to a structure or similar rigid system. In turn, the lanyard is secured to an anchor point.
 - d. Lineman's body belt - is a device worn around the body, just above the hips, which connects the body to other life-supporting systems (safety strap).
 - i. Lineman's body belts are to be used by qualified climbers only. Traditional body belts are not acceptable as part of a personal fall arrest system in any other application.

2. Personal Fall Arrest components shall be made available to any MMU employee required to work at heights of 4 feet or more and is/may be exposed to a fall hazard.
3. Each component of the fall arrest system shall comply with current ANSI standards as they pertain to impact and shock loading. Testing procedures of individual components shall comply with U.S. federal regulatory agency testing requirements.
 - a. Anchorages are a primary component of fall protection. Anchorages used for attachment of personal fall arrest equipment shall be independent of any anchorage being used to support or suspend platforms and capable of supporting at least 5,000 pounds per employee attached.
4. The following operations or situations shall require the wearing of a personal fall arrest system.
 - a. Where other protection is not afforded, i.e. guardrails, safety nets, etc.
 - b. On any scaffold over 4 feet above floor or ground level where guardrail systems have not or cannot be provided, employees will be required to use harnesses and lanyards/SRL(s) to prevent their falling.
 - c. Employees working from aerial lifts shall wear a full body harness with a self-retracting lifeline (Scorpion, Yo-Yo, etc), attached to the appropriate anchor point on the aerial lift.
 - d. On poles or towers by qualified employees when conditions exist such as, but not limited to, ice, high winds, or the presence of contaminants (acids, oils, grease, etc) that could cause the employee to lose their grip or footing; or, when equipment, materials, or other obstructions are present below the pole which create impalement hazards in the event of a fall.
 - i. **Note: Fall arrest equipment is not required for qualified climbers who are climbing or changing positions on poles, towers, or similar structures unless conditions such as, but not limited to, those listed above exist. This exclusion does not apply to un-qualified climbers undergoing on-the-job training, even though they may be considered qualified employees for other purposes.**
 - e. Any other situation where an employee is exposed to falls, where other safety devices or guards are not provided.
5. Personal fall arrest systems and components that are subjected to an actual impact load or load test will be removed from service immediately. All components of that system shall not be used again for employee protection until inspected and determined by a competent person to be undamaged and suitable for reuse.
6. Full body harnesses, lanyards, body belts and all other components (as part of a personal fall arrest system or positioning/climbing device system) shall be used only for employee protection and not to hoist materials.
7. Any lifeline/anchorage point in use should be attached directly over the area where the employee is working to minimize fall distance.
8. Lifelines/anchorage points shall be moved as work progresses to keep in line with the work area to minimize fall distance.
9. Before each use, all harnesses, lanyards and lifelines shall be thoroughly inspected being certain they are not damaged or deteriorated. Any damaged or deteriorated equipment shall be immediately removed from service.

10. Additional care should be taken when storing harnesses, lanyards and/or lifelines to protect them from damage.

GUIDELINES FOR PERSONAL ARREST SYSTEMS

The following information constitutes additional guidelines for use in complying with requirements for a personal fall arrest system.

SELECTION AND USE

1. The kind of personal fall arrest system selected should match the particular work situation, and any possible free fall distance should be kept to a minimum. 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 is anticipated. As a standard requirement, you must plan to have means available to promptly rescue an employee should a fall occur, since the suspended employee may not be able to reach a work level independently.
2. Where lanyards, connectors, and lifelines are subject to damage by work operations such as welding, chemical cleaning, and sandblasting, the component should be protected, or other securing systems should be used. Supervisors should fully evaluate the work conditions and environment (including seasonal weather changes) before selecting the appropriate personal fall protection system. Once in use, the system's effectiveness should be monitored. In some cases, a program for cleaning and maintenance of the system may be necessary.

COMPONENT CAPABILITY

Ideally, a personal fall arrest system is designed, tested, and supplied as a complete system. However, it is common practice for lanyards, connectors, lifelines, deceleration devices, and body harnesses to be interchanged since some components wear out before others. You should realize that not all components are interchangeable. For instance, a lanyard should not be connected to a harness and a deceleration device of the self-retracting type since this can result in additional free fall for which the system was not designed. Any substitution or change to a personal fall arrest system should be fully evaluated or tested by a competent person to determine that it meets that standard, before the modified system is put in use.

EMPLOYEE TRAINING

Thorough employee training in the use of personal fall arrest systems is imperative. All employees must be trained in the safe use of the system. This should include the following: application limits, proper anchoring and tie-off techniques, estimation of free fall distance, including determination of deceleration distance and total distance to prevent striking a lower level, methods of use, and inspection and storage of the system. Careless or improper use of the equipment can result in serious injury or death. Supervision and craft people should become familiar with the manufacturer's recommendations before a system is used. Tie-off considerations and maximum permitted free fall distance should always be evaluated. Tie-offs such as using knots or tying around sharp edges can seriously reduce the integrity of the lanyard. In the event of a fall, the supervisor/employee must evaluate the maximum fall distance so a system is used that will prevent the fallen person from striking an object or leave them immovable in a hazardous position. Employees must also be trained on the importance of inspections prior to use, the limitations of the equipment, and any unique conditions at the worksite that may warrant a specific type of fall arrest system.

RESCUE

When personal fall arrest systems are used, you must assure that employees can be promptly rescued or can rescue themselves should a fall occur. The availability of rescue personnel, ladders, or other rescue equipment should be coordinated prior to use. In some situations, equipment, which allows employees to rescue themselves after the fall has been arrested, may be desirable, such as devices, which have descent capability.

INSPECTION

Personal fall arrest systems must be inspected by the user before each use. Any component with any significant defect, such as cuts, tears, abrasions, mold, or undue stretching; alterations or additions which might affect its efficiency; damage due to deterioration; contact with fire, acids, or other corrosives; distorted hooks or faulty hook springs; tongues unfitted to the shoulder of buckles; loose or damaged mountings; nonfunctioning parts; wearing or internal deterioration in the ropes; or systems subject to a previous fall must be withdrawn from service immediately, and should be tagged or marked as unusable, or destroyed.

TIE-OFF

1. One of the most important aspects of personal fall protection systems is fully planning the system before it is put into use. Probably the most overlooked component is planning for suitable anchorage points. Such planning should ideally be done before start of any new process, or in conjunction with current processes, so that anchorage points can be incorporated for later use.
 - a. Properly planned anchorages should be used if they are available. In some cases, anchorages must be installed immediately prior to use. In such cases, a registered professional engineer with experience in designing fall protection systems, or another qualified person with appropriate education and experience should design an anchorage point to be installed.
 - b. Examples of what might be appropriate anchorage points are steel members or I-beams if an acceptable strap is available for the connection; large eyebolts made of an appropriate grade steel; guardrails or railings if they have been designed for use as an anchorage point; masonry or wood members only if the attachment point is substantial and precautions have been taken to assure that bolts or other connectors will not pull through. A qualified person should be used to evaluate the suitability of these anchorages with a focus on proper strength.
2. Be aware that the strength of a personal fall arrest system is based on its being attached to an anchoring system which does not reduce the strength of the system (such as a properly dimensioned eye-bolt/snap-hook anchorage). Therefore, if a means of attachment is used that will reduce the strength of the system, that component should be replaced by one that will maintain the appropriate maximum arrest force characteristics.
3. Tie-offs using a knot in a lanyard or lifeline can reduce the lifeline or lanyard strength by 50% or more, therefore, knots shall never be used to secure a lifeline or lanyard to a tie-off point.
4. Tie-offs where the line passes over or around rough or sharp surfaces reduces strength drastically. Such a tie-off should be avoided or an alternative tie-off rigging should be used. Such alternatives may include use of a snap-hook/D-ring connection, wire rope tie-off, an effective padding of the surfaces, or an abrasion-resistant strap around or over the problem surface.

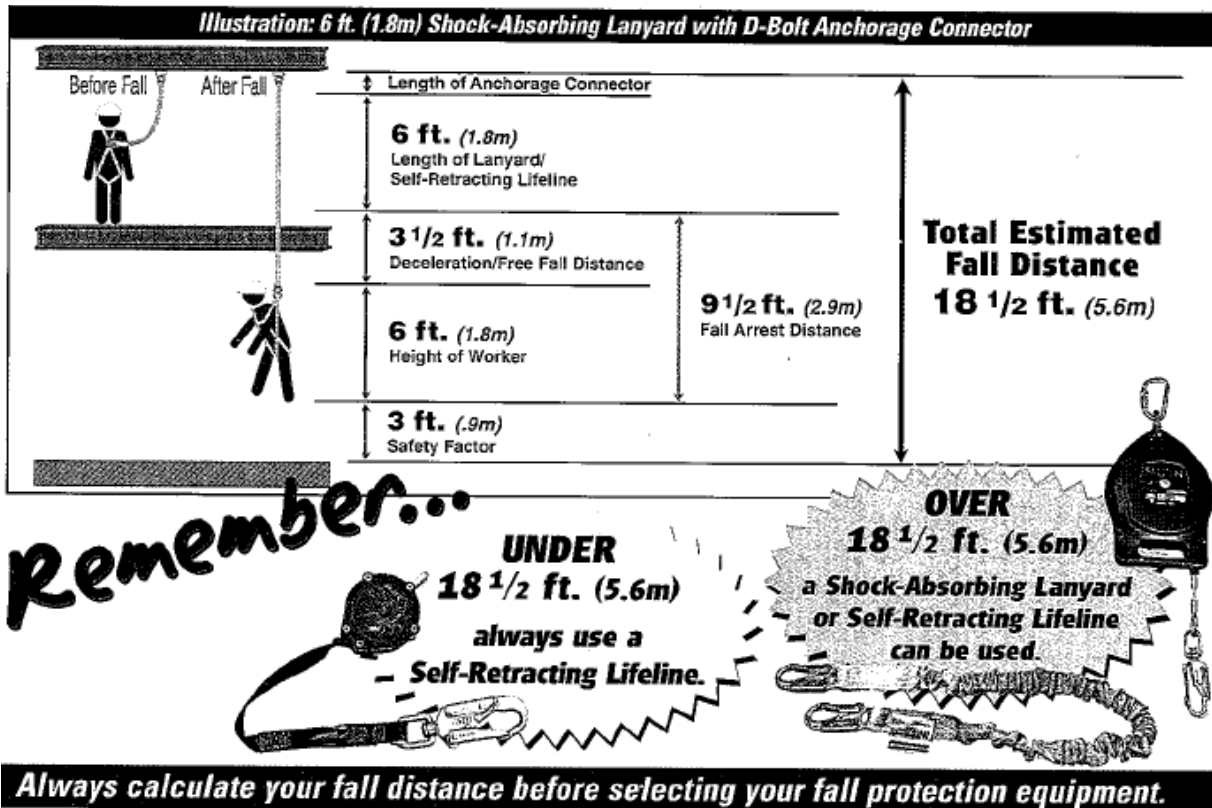
5. Horizontal lifelines may, depending on their geometry and angle of sag, be subjected to greater loads than the impact load imposed by an attached component. When the angle of horizontal lifeline sag is less than 30 degrees, the impact force imparted to the lifeline by an attached lanyard is greatly amplified. For example, with an angle of 15 degrees, the force amplification is about 2:1 and at 5 degrees sag, it is about 6:1. Depending on the angle of sag, and the line's elasticity, the strength of the horizontal lifeline and the anchorages to which it is attached should be increased a number of times over that of the lanyard. Extreme care should be taken in considering a horizontal lifeline for multiple tie-offs. In multiple tie-offs to a horizontal lifeline, if one employee falls, the movement of the falling employee and the horizontal lifeline during arrest of the fall may cause other employees to fall as well. Horizontal lifeline and anchorage strength should be increased for each additional employee tied off. For these and other reasons, the design of the systems using horizontal lifelines must be done by qualified persons. Testing of installed lifelines and anchors prior to use is recommended.
6. 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.
7. Vertical lifeline considerations. As required by the standard, each employee must have a separate lifeline when the lifeline is vertical. In multiple tie-offs to a single lifeline, if one employee falls, the movement of the lifeline during the arrest of the fall may pull other employees' lanyards, causing them to fall as well.

SNAP-HOOK

Locking snap-hooks designed for connection to suitable objects (of sufficient strength) are required. Locking snap-hooks incorporate a positive locking mechanism in addition to the spring-loaded keeper, which will not allow the keeper to open under moderate pressure without someone first releasing the mechanism. Such a feature, properly designed, effectively prevents rollout from occurring.

FREE FALL

Be aware that a system's maximum arresting force is evaluated under normal use conditions established by the manufacturer, and in no case using a free fall distance in excess of 6 feet. A few extra feet of free fall can significantly increase the arresting force on the employee, possibly to the point of causing injury. Because of this, the free fall distance should be kept at a minimum, and, as required by federal standards, in no case greater than 6 feet. To help assure this, the tie-off attachment point to the lifeline or anchor should be located at the highest level possible. (Since otherwise additional free fall distance is added to the length of the connecting means (i.e. lanyard). Attaching to the working surface will often result in a free fall greater than 6 feet. Using a six foot lanyard, a person ties-off at their walking/working level (meaning they tie-off at their feet), If a fall occurs add 5 feet from the D-Ring to the walking/working level, plus 6 feet for the length of the lanyard, plus 3 feet for the shock absorber; $5 + 6 + 3 = 14$ Feet. This persons feet will actually be 14 feet below the walking/working surface. Another important consideration is that the arresting force, which the fall system must withstand, also goes up with greater distances of free fall, possibly exceeding the strength of the system. Use the following chart to help determine which type of lanyard to be used:



OBSTRUCTION

Consider the location of the tie-off for obstruction hazards in the potential fall path of the employee. Tie offs, which minimize the possibilities of exaggerated swinging (pendulum effect), should also be considered.

OTHER

Because of the design of some personal fall arrest systems, additional considerations may be required for proper tie-off. For example, heavy deceleration devices of the self-retracting type should be secured overhead in order to avoid the weight of the device having to be supported by the employee. Also, if self-retracting equipment is connected to a horizontal lifeline, the sag in the lifeline should be minimized to prevent the device from sliding down the lifeline to a position, which creates a swing hazard during fall arrest. In all cases, manufacturer's instructions should be followed.