Chapter II – Anchorage Points

2.1 Single Anchor Points

An anchorage point is a secure location of attachment where a worker may connect their harness. It is usually a structural member, such as an I-beam, rebar, roof structure, concrete, or a wood truss of sufficient strength to withstand fall forces. OSHA gives the employer two options when it comes to selecting an anchorage point that will be deemed to meet its strength requirements. The first of these is a set number:

- Capable of supporting a static load of at least **5,000 pounds (22.2kN) per employee**

Often a worker must perform a task in an area but is unsure about whether the anchor that they would like to select is strong enough; this is where the second option comes in. OSHA says that here the anchor must be designed:

- As part of complete personal fall arrest system which maintains a safety factor of at least two; ***and***
- Under the supervision of a ***qualified person***."

This is where the Tritech Fall Protection comes into play. What OSHA is stating is that this person must analyze the entire personal fall arrest system (PFAS) setup and determine whether the anchorage point would be able to hold at least two times the forces that would be imposed upon it in the potential fall.

OSHA stipulates that a PFAS "must limit maximum arresting force on an employee to 1,800 pounds (8 kN)." This means that if the worker falls, they shall never feel a force of more than 1,800 pounds imposed on their body, which is also the force that the anchor will feel. Many engineers will double this figure of 1,800 pounds, giving a minimum strength of 3,600 pounds for any anchor that they choose.

Anchorage Strengths for the PFPS		
1st Option	• 5,000 lbs. per Attached Worker	"Non-Certified"
2nd Option	• Safety Factor of 2 by a Qualified Person	"Certified" (by a Q.P.)

2.1.1 The Anchorage Connector

Once an anchorage point of appropriate strength is identified, the next question becomes how to connect to it. Since it is impermissible to wrap your lanyard or self-retracting lifeline directly around the point itself (doing what is known as "choke-loading"), you will need to find an anchorage connector that is designed for the type of anchor that you have found.

- Note: ***Choke-loading*** is impermissible with *most* lanyards and SRLs (self-retracting lifelines) because their line was not designed to wrap around rough surfaces that could be damaging. Their snap hooks also were not designed for such a connection.

Anchorage connectors may be classified as *temporary* or *fixed*:

- Temporary – Designed to be installed as needed around the worksite, removing at the end of the job.
- Fixed – Remains in the location where it is installed on a permanent basis for future use.

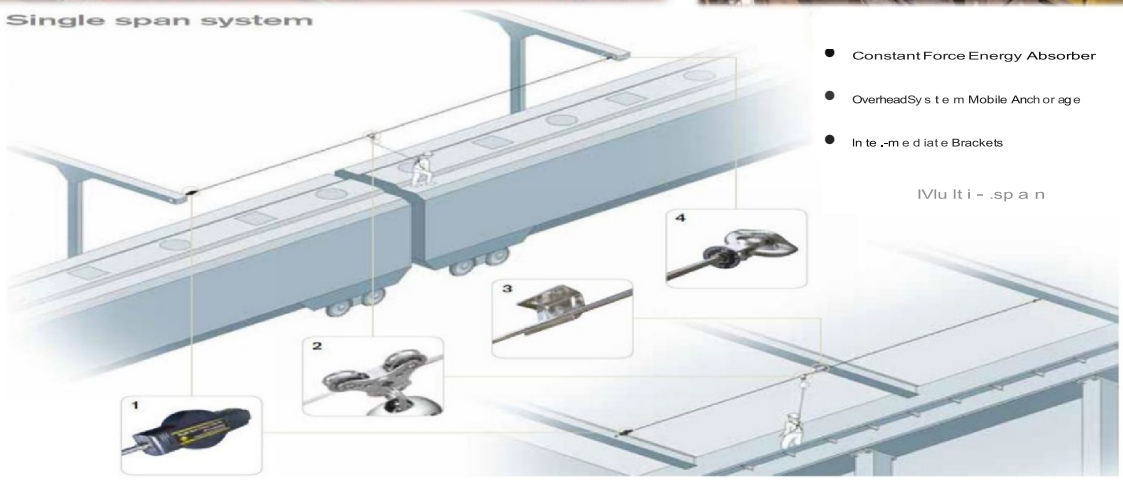
Temporary Anchorage Connectors		
 Cross-Arm Strap	 Sliding Beam Clamp	 Fixed Beam Clamp
 Removable for Concrete	 Friction-Based Connectors	 Reusable Roof Anchor

Fixed Anchorage Connectors		
 D-Plate Connector / MEGA Swivel	 Fixed Roof Connector	 Weld-On Puck

2.2 Horizontal Lifelines

Another type of more complex anchorage connector is what is known as a "horizontal lifeline" (HLL). This is a line that is suspended between two points, giving workers a great amount of horizontal mobility. Common systems are 30 or 60 feet in length to allow for situations where a great deal of side-to-side mobility is needed.

Permanent HLLs can be installed in areas where the worker needs the ability to move around on more of a regular basis. These types of lifelines are installed in a wide variety of different situations, including on building rooftops, in the rafters of sports stadiums, on bridges, and on overhead crane rail runways, or above "rolling stock" such as train cars.



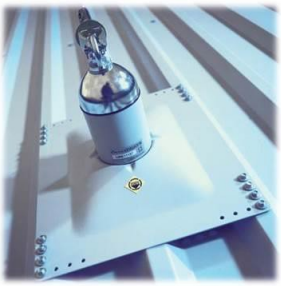
Note: With a more complex anchorage connector such as this, whether it is a temporary "kit" system or a more permanent line, OSHA provides restrictions on who may participate in the design:

"The employer must ensure that each horizontal lifeline is designed, installed, and used ***under the supervision of a qualified person***; and is part of a complete personal fall arrest system that maintains a safety factor of at least two."

2.3 Horizontal Lifelines for Roofs

Providing fall protection on roofs continues to be a topic of significant interest. Here, just like on any other work surface, fall protection of some sort is required. In some cases, for aesthetic reasons or because the roof design will not permit guardrails, many companies have looked for other options for fall protection.

Standing Seam



Composite

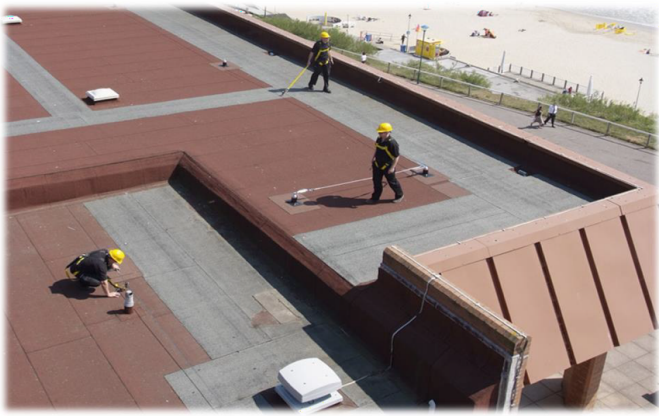
Secret Fix

Membrane

One option that has become more and more common is the installation of fixed anchorage connectors that anchor directly to the roof structure and utilize energy absorber technology (in this case being the Constant-Force Coil) to minimize force imparted on the point of securement in the fall. Attachment in this case depends on the roof type, including fixation through clamps (standing seam), stitching screws (composite roofs), rivets (secret fix), and toggle bolts which penetrate down through the top surface of membrane-style roofs.

Common characteristics include:

- May be a single, fixed anchor point, or united/tied together as a horizontal lifeline.
- Fixation to below roof structure often is not necessary, instead often relying on roof panels themselves.
- May be designed for ***fall restraint*** or ***fall arrest***, based on the level of control wanted / needed.
- Frequently may accommodate multiple users (going up to as many as 5 in some cases)



2.4 Rigid Rail Systems

Some applications call for a rigid rail system rather than a horizontal lifeline. Rigid rail systems are most commonly required due to limited fall distances but can also be a requirement of the location of the installation or the elements that it is exposed to.

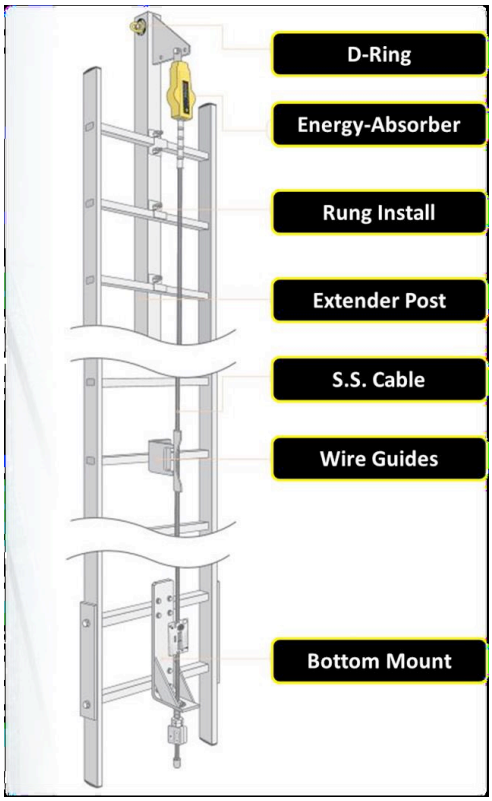
Similar to horizontal lifelines, rigid rail systems are installed between two anchor points where the worker requires horizontal mobility. Some common applications for rigid rail systems are to provide access over a truck loading station, aircraft hangars, or over conveyors where the deflection of a horizontal lifeline can exceed the available fall distance.

Another advantage of rigid rail systems is the mobility that they provide. Some of these systems have the capability to be moved into position to provide access to various sizes and shapes of equipment beneath, or in some cases they can be moved completely out of the way and only put into use when coverage is required.

2.5 Vertical Lifeline Systems

As opposed to needing to move from side to side, a worker may need continued mobility up and down, such as when climbing up or down a ladder. One of the options here may be the use of a "vertical lifeline" system.

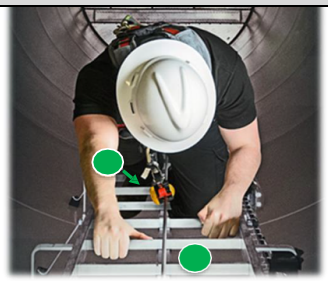
For locations where more permanent protection is needed to a vertical location, such as climbing an access ladder to a warehouse mezzanine, permanent vertical lifelines are becoming more and more the norm.



In the past the most common type of fall protection seen on fixed ladders was the "ladder cage," pictured here. However, as of November 19, 2018, what OSHA permits for fall protection on fixed ladders began to change for ***fixed ladders that extend more than 24 feet (7.3 m)*** above a lower level. For systems installed before this time, ladder cages will be "grandfathered" until 2036. For any built after this time, the required controls are:

- Personal Fall Arrest System (overhead SRL); or
- Ladder Safety System (VLL) – 1910.28(b)(9)(i)(B)

Harness w/ Front D / Ladderlatch
Permanent Vertical Lifeline

Permanent Vertical Lifeline System In-Use	
	1.) Cable Lifeline 2.) Ladderlatch to Harness Front "D-Ring"
	Common Application Areas
	• Building Industrial Ladders (mezzanine, roof); • Utility Transmission Towers • Silos, Smokestacks, other Vertical Structures

2.6 Additional Important Notes on Anchorage Points

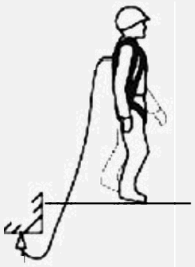
While finding an anchorage of proper strength as well as a means to connect to it are greatly important, there are some additional considerations that must be looked at when selecting an anchorage point.

Anchor Location

Too Much Free Fall –

Although not possible in all situations, finding an anchorage point that is both above and vertically in line with the worker is critically important for most types of connecting devices that may be used. If the anchor is not above the worker, the worker will free fall a distance greater than their system has been designed to be able to withstand. This could be very dangerous for the worker due to high fall forces that cannot be safely dissipated.

- Free fall is the distance that the worker travels before the connecting device of their PFAS starts to catch.
  - The farther one falls before their connectors starts to catch, the greater the amount of force to stop.
  - Too much free fall (from a foot-level tie-off) will overwhelm the braking capacity of most connecting devices.
  - Aim for a tie-off at ***shoulder-level or higher***.

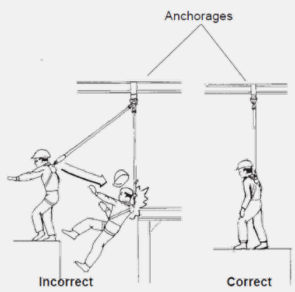


Swing Fall –

Another issue with location is that the anchor needs to be as close to being in-line with the worker as possible. If not, the potential for a "swing fall" will exist. This is a situation where when the worker falls and their lanyard begins to catch, gravity will automatically pull them back towards the point below which they were anchored.

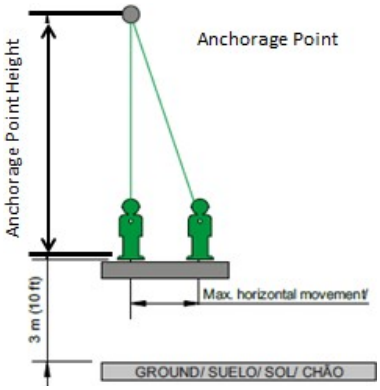
If there are any obstructions in the way, the fall victim may strike them with nearly as much force as hitting the ground. As a result, most manufacturers will put a limitation on how far the worker may work to the side of their anchor.

- Where a worker swings horizontally from their anchorage because of too much movement away from it.
  - A worker can hit an object while swinging with ***as much force*** as hitting the ground in a straight-down fall.
  - Keep anchor ***above*** & vertically ***in line*** with the worker.
  - Avoid walking too far in any direction away from an anchorage point, especially with a large SRL.



Swing fall issues commonly come up when workers are using self-retracting lanyards that allow line to pay out as they walk away from the device. As a general rule, these devices must be used only overhead, and should **NOT** ***be laid at ground level*** so that workers have horizontal mobility. The issue that can arise is that in the case of a fall not only will the unit likely not function correctly, but a massive swing fall will result, and the worker may even strike a lower surface due to inadequate clearance.

Often the question arises as to how far a worker can walk in different directions when hooked up to an overhead SRL. As the charts below show, the distance is proportional to the height of the device anchorage over the worker's head.



Example of Maximum Horizontal Movement Below an Anchorage

Swing Fall Questions for You – Use the chart above.

1) How far may the worker move to the side when the SRL is anchored 12' overhead?_____
2) How much side movement allowed when this changes to 32' overhead?_____

Rescue

The worker must always consider how accessible they will be for rescue if they were to fall and be suspended from the selected anchorage point, as the longer they hang, the more potential there is for "suspension trauma."

- OSHA:
  - "The employer must provide for prompt rescue of each employee in the event of a fall." – 1910.140(c)(21) / 1926.502(d)(20)
- Tritech Fall Protection:
  - As a general guide, Tritech recommends that a company should aim to rescue a fallen worker ***within 15 minutes***.
  - Don't work until a rescue plan has been decided.