eGUIDE

FALL FACTORS AND FORCES

As much as we try to put measures in place to prevent workers from falling while working at a height, there is still a possibility that a person could accidentally fall. When a person falls from a height, their bodies and equipment generate energy. The greater the fall distance, the greater the energy they will produce. This energy is known as 'fall force' or 'impact force' and can be potentially life threatening if it is too large.

Fall factors are simple equations that are used to calculate what the forces would be in the event that a person falls. The equation considers the type of fall arrest equipment that is used as well as where the person was anchored to when they fell. Because fall factors and forces have a serious impact on the health and safety of the people working at height, it is important that they are known and understood. While all this information can get quite technical, there are some basic concepts that workers can use to keep themselves safe while working at height.

HOW FALL FACTORS WORK

A fall factor is the ratio between the height that a person falls and the free length of the workers lanyard that has been made available to absorb some of the forces of the fall. Values of fall factors are calculated between 0 and 2 (anything higher than 2 would be considered as a fatal fall). This calculation is done by dividing the height of the fall by the length of the lanyard or rope that the person is connected to which will result in a value. The lower the value of the fall factor, the less impact forces are applied to the body of the person and the 'safer' the fall. On the other hand, the higher the value, the greater the impact forces on the body will be and the more likely it is that serious injuries are sustained.

For example: Let's take a person that is working at height using a double shock absorbing lanyard and assume that their lanyard is anchored above their head while they are working. To calculate the theoretical fall factor, we use the following equation:

$$\text{Fall Factor} = \frac{\text{Height of the fall}}{\text{Length of the free lanyard}}$$

The value of the lanyard we round off to 2 m (this factors in the lanyards length as well as a safety margin for any stretch in webbing that could happen after a fall). The lanyard is anchored above the workers head so there will be little to no distance they are falling. Putting these figures into the equation helps to calculate what the theoretical fall factor would be:

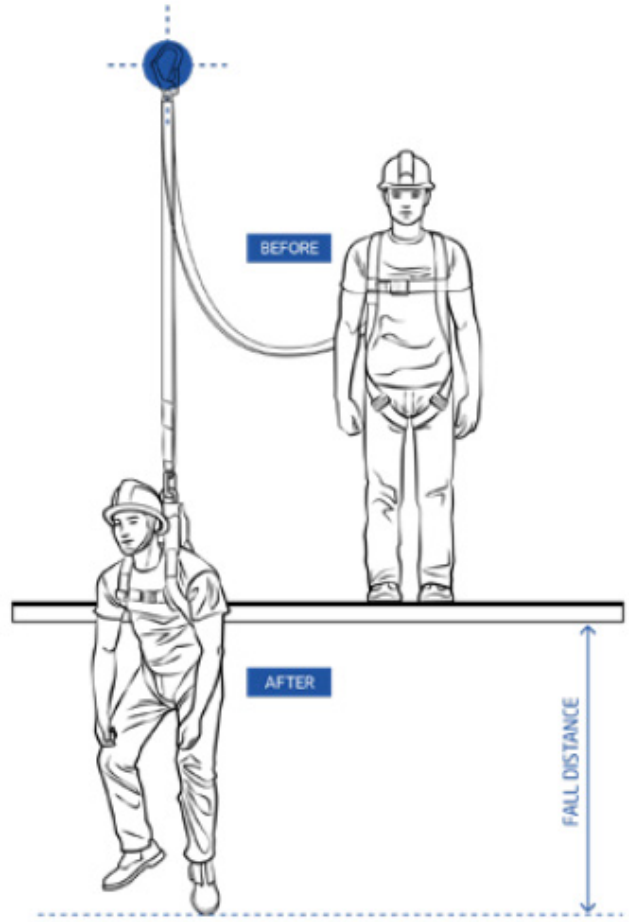
$$\text{Fall Factor (0)} = \frac{\text{Height of the fall (0 m)}}{\text{Length of the free lanyard (2m)}}$$

Therefore, FF = 0.

We refer to these calculations as theoretical as they do not entirely cover real life situations as elements such as rope stretch, deflection of wire rope and energy absorber deployment could all have an impact on the forces as well. However, a fall factor of 0 is the most ideal position to be in to minimise injury if a person should accidently fall. It is important to note that the fall factor is a way to indicate the severity of a fall and not an exact way to measure the impact forces.

This image portrays fall factors 0 to 2:

At a fall factor 1 it can be seen that the person's lanyard was anchored at waist height/shoulder height, which allowed them to fall a small distance due to the extra slack in the lanyards webbing. This would have resulted in minor injuries but possibly not be fatal. The person working with their lanyard anchored at their feet would be considered to be connected in a fall factor 2 position and would fall a great distance because of the large amount of slack in the lanyards webbing. This type of fall would theoretically result in major injuries and possibly even be fatal.



There are two major things that play a role in determining what the fall factor would be or how serious the fall would be:

1. The position of the person's anchor point in relation to their harness connection, and
2. the type of fall arrest device that is being used.

If you are able to identify and select these two items correctly, you will be able to maintain a fall factor 0 when working at a height.

CHOOSING THE RIGHT EQUIPMENT

Any person working at height will be connected to their anchor point through some kind of fall arresting device. These devices can range from lanyards to mechanical locking devices (mobile fall arrestors) that grab onto rope. Because there are multiple functions for each device, it all rests on the person's training and competence in using the equipment and selecting suitable anchor points.

Lanyards are a good choice when the worker's anchor point is installed at a short distance away and the worker needs the additional length in the webbing to be able to move while working. Situations where lanyards would be the appropriate choice would be places like truck loading bays with overhead anchors or lifelines, walkways at a height where there are structural beams above to anchor to, etc. Mobile fall arrestors have very little slack in movement when there is a fall as they are designed to lock onto the rope or wire immediately following a fall. These devices are best used when the person is working in a vertical position at all times and would therefore be exposed to a greater risk of falling. These devices are often seen being used on vertical lifeline systems installed on fixed ladders, where the person can attach directly to the front of the harness and climb up and down with ease.

Although fall factors are theoretical equations, applying them to real life situations could potentially save lives. Keeping the above information in mind will assist in choosing the most appropriate configuration for fall protection systems and whenever possible, strive to minimize the fall factor to a 0.