The Work At Height Safety Association

Technical Guidance Note 4

"Guidance on the use of single and twin energy absorbing lanyards"

A series of informative notes for all industries involved with work at height or rescue.

WAHSA technical guidance note no. 4

Guidance on the use of single and twin energy absorbing lanyards

Introduction

This information sheet gives guidance on the selection, use, maintenance and inspection of energy absorbing lanyards for work at height.
Fatalities have occurred in the UK and elsewhere owing to the failure of energy absorbing lanyards.

As is the case with most accidents, the failures could be attributable to a failure of the product, a failure of the user to use the product correctly, or a combination of both.

Although energy absorbing lanyards may appear to be straightforward to use, there are simple rules which must be followed to ensure that the product is in proper condition for use, and that the chosen product is suitable for the intended application.
Probably the most widespread type of fall arrest system used in industry is the combination of a lanyard and an energy absorber used to link a harness to a suitable anchor.

Some of the fatalities referred to above could have been avoided if a simple pre-use check had been carried out, or the user had followed some elementary rules about how the product should be used.

1.0 What are energy absorbing lanyards?

Energy absorbing lanyards are used as part of a fall arrest system to connect a person's harness to an anchor. In the event of a fall they should limit the impact force on a person to a maximum of 6kN. When two single energy absorbing lanyards are used in conjunction with each other they are referred to as double energy absorbing lanyards.

1.1 Lanyards

A lanyard is a flexible link between other components such as a harness and an anchor device, of a fall protection system. They are typically made from textile rope or webbing with a termination at each end formed by a connector, a spliced eye or a sewn loop.

Lanyards should conform to European Standard BS EN 354: 2010 *Personal Fall Protection Equipment - Lanyards,* which requires an ultimate tensile strength of 22kN for lanyards made from textile material or have textile elements, and 15kN for lanyards made entirely from metallic materials including terminations and lanyard fittings.

WARNING: If lanyards are used without energy absorbers, as a link between the user's harness and an anchor, they must only be used for work restraint (see section 3.3). Work restraint becomes work positioning at the point when the connection between the body holding device and the reliable anchor begins to provide support to the user, which the user needs to rely on to maintain his position.

1.2 Energy absorbers

If a user falls onto a 2m long textile lanyard (without an energy absorber), the force on the user and the anchor would be unacceptably high, therefore all fall arrest systems must contain an energy absorbing element, which limits the impact force to 6kN.

The item most commonly used to achieve this is typically known as an "energy absorber", comprising of a block of webbing which is either woven or stitched together, and opens progressively to dissipate energy in the event of a fall.
Energy absorbers must conform to BS EN 355: 2002 *Personal protective equipment against falls from* a *height - Energy absorbers* which limits the maximum impact force on a person to 6kN during deployment and requires a minimum tensile strength of 15kN after deployment.

Energy absorbers are generally designed to be used in conjunction with a lanyard such that the combined length of all elements is no more than 2m before deployment of the energy absorber. To ensure that the impact force is less than 6kN in the event of a worst case fall with such a product the energy absorber may need to extend up to 1.75m, thus providing a relatively gentle braking effect.

1.3 Energy absorbing lanyards

Some energy absorbing lanyards are formed as single products which perform both of the functions (see 1.1 and 1.3). Energy absorbing lanyards may be attached separately to a harness or may be permanently attached to the harness.
The performance requirements for energy absorbing lanyards are the same as for an energy absorber alone (BS EN 354: 2010 *Personal Fall Protection Equipment - Lanyards*). They should have a minimum tensile strength of 15kN.

2.0 When should energy absorbing lanyards be used?

2.1 Single energy absorbing lanyards

Single energy absorbing lanyards are generally used when the area of work is close to a suitable anchor point.

It is a popular misconception that energy absorbing lanyards should not be used for work restraint. The British Standard Code of practice for selection and use of fall protection equipment in the workplace (BS 8437: 2005) part 8.2.2 specifies that "an energy absorbing lanyard of the correct length may be used for restraint provided ... it will not be subjected to a force that could cause the energy absorber to deploy".

2.2 Double energy absorbing lanyards (two single lanyards used simultaneously)

These items are used in similar situations to single energy absorbing lanyards, but are recommended by WAHSA for the reasons outlined above. As well as the potential of high impact forces, they have the advantage of being lighter and less bulky.

It is important to be aware of safety critical aspects of using twin energy absorbing lanyards and to note especially that the spare arm of a twin energy absorbing lanyard should never be attached to a different load bearing point on your harness e.g. side attachment rings. Incorrect attachment might prevent the energy absorber from opening fully in the event of a fall.

Depending on the design of the twin energy absorbing lanyard and the relative lengths of the arms and the energy absorbing element, the incorrect attachment of the spare arm could cause the junction between the arms of the energy absorbing lanyard to fail, leading to total catastrophic failure of the lanyard itself. At least one fatality is known to have occurred as a result of this. Some energy absorbing lanyards may employ a metal connection at the junction of the arms to prevent this catastrophic failure.

When only one arm of the energy absorbing lanyard is attached, the spare arm should only ever be stored in one of the following ways:

- clipped back to a point or ring on the energy absorber itself on the side away from the body
- clipped to a "sacrificial" loop on the harness which will easily detach, but only if it has been tested and approved by the manufacturer
- allowed to hang free
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Depending on the intended use, some twin energy absorbing lanyards may have shorter arms than standard energy absorbing lanyards to reduce entanglement when ladder climbing or working on steel structures.

2.3 Twin energy absorbing lanyards

WAHSA strongly recommends that twin legged energy absorbing lanyards are used in preference to two single energy absorbing lanyards used simultaneously. Twin lanyards have the advantage that the lanyards are integrated into a single energy absorber.
If two single energy absorbing lanyards used simultaneously are connected to an anchor when the user is transferring from one point to another the impact force would be twice what it would if only one energy absorbing lanyard was attached as with a Twin Lanyard. This is due to the load being shared by two energy absorbers, which could result in reduced energy dissipation. It would not be difficult in such a situation to exceed the CEN recommended value of 6kN.

3.0 Safety Issues

Several safety issues have been raised with respect to these products, as follows:

- clearance distance below anchor points
- methods of use of single and twin energy absorbing lanyards
- the use of energy absorbing lanyards for restraint purposes
- the effects the weight of the user may have on the performance of energy absorbers

3.1 Clearance distance below anchor points

It is essential that enough clearance is allowed below the anchor point to allow for the full extension of the energy absorbing lanyard to arrest a fall.

The following calculation may be used as a guide to a suitable clearance distance in such situations:

User height + lanyard length + energy absorber extension + safety margin = 2m + 2m + 1.75m + 1m = 6.75m

Note: If used in conjunction with flexible lifelines or deadweight anchors an additional deflection will occur. Further advice on ground clearance relative to the position of the anchor may be provided by the manufacturer. Confirmation should be sought from flexible lifeline manufacturers that they are suitable for use with energy absorbing lanyards.

3.2 Methods of use of double and twin energy absorbing lanyards

This topic is discussed in full in the "Using energy absorbing lanyards" section.

3.3 The use of energy absorbing lanyards for restraint purposes

If lanyards are used without energy absorbers, as a link between the user's harness and an anchor, they must only be used for work restraint, i.e. typically on a level surface to prevent the user from entering a zone where a fall might occur. They should not be used without an energy absorber in any situation where the user could experience a fall through a surface they could stand on, or from an edge.
The only load placed on a restraint lanyard should be that resulting from a "fall on the level", i.e. a slip or a trip.

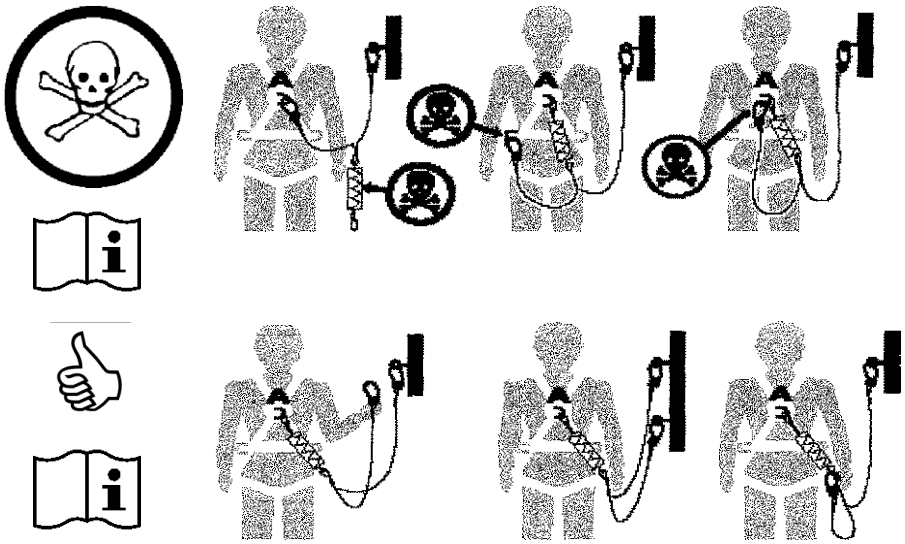
4.0 Using energy absorbing lanyards

Energy absorbing lanyards are used in single and twin configurations. Energy absorbing lanyards are available in lengths of up to 2 m but shorter versions should be considered wherever possible to reduce the potential free fall distance and associated risks.
No matter what type of energy absorbing lanyard is being used, it is important to ensure that certain critical safety measures are observed:

- the item is in good condition
- the user has checked the condition and security of all elements before use
- the energy absorbing lanyard is CE marked and tested to the relevant standard
- the energy absorbing lanyard has not been in use for more than 5 years
- the terminating connector is suitable for the type of anchor
- the terminating connector is CE marked to BS EN 362: 2004 *Personal protective equipment against falls from a height – connectors*
- a suitable anchor is being used (strength and type of connection)
- the position of the anchor is appropriate (as high as possible above the user)
- sharp edges are avoided
- the energy absorber element is positioned next to the body not to the anchor
- sufficient clearance has been allowed
- the energy absorbing lanyard has not been extended or elongated
- the energy absorbing lanyard is not kinked, knotted or twisted
- the user should avoid climbing substantially above the anchor point

Note: see WAHSA TGN 01 **"10 points for the use of fall protection equipment"** for further guidance on essential considerations when using this equipment.

Correct and incorrect methods of use of twin legged energy absorbing lanyards



5.0 Inspections and checks

For general information about inspecting fall protection equipment see WAHSA TGN03. This indicates several types of inspection, such as pre-use checks (carried out by the user), detailed inspection (sometimes referred to as 'periodic examination') and, where required, interim inspection (see also INDG367 – HSE).

5.1 Pre-use checks

Only visual inspections should be carried out on lanyards and or energy absorbers, proof load testing should **not** be carried on lanyards and or energy absorbers.
There are a wide range of possible causes of degradation of the materials used in lanyards and or energy absorbers, including abuse, general wear and tear, edge/surface damage, ultraviolet fight, dirt, grit, chemicals, droppings, subjection to excessive loading, fails. Textiles deteriorate slowly with age regardless of use. The most common cause of strength loss in textile equipment is through abrasion (either by grit working into the strands or by chafing against sharp or rough edges) or by other damage such as cuts. Any single or twin energy absorbing lanyard showing signs of damage such as this should be scrapped. Single or twin energy absorbing lanyards that have suffered a shock load (impact force) should be scrapped. If an energy absorber shows signs of damage or deployment is should be scrapped.

Single or twin energy absorbing lanyards must be inspected by the user before use (pre use inspection), and on a regular basis by a competent person (detailed inspection).

Recent research has highlighted that there is no well-defined boundary (e.g. usable life) separating equipment that is safe to use and that which is not. The safest course of action is to scrap any component about which there is any doubt. Only visual inspections should be carried out, proof load testing should **not** be carried on lanyards and or energy absorbers.

5.1.1 Fibre rope, webbing and wire rope checks

The following lists the principal causes of deterioration in fibre rope, webbing and wire ropes. The block should be immediately withdrawn from use should any of these be evident.

Fibre rope

- crushing – flattened or bent section of fibre rope
- abrasion – localised wear

Webbing

- abrasion – localised wear
- chemical attack
- contamination
- nicks and cuts
- damaged stitching
- UV degradation e.g. fading

Wire rope

- crushing - flattened or bent section of wire rope
- cutting - damaged strands and broken wires
- abrasion - localised wear; where outer strands appear flattened and with brighter appearance
- strand core protrusion (“bird-caging”) - the central core showing with the outer strands swelling out
- kinking - deformation of wire rope
- corrosion - roughness and pitting with broken wire propagating from cracks or pitting
- electric arcing or heat damage - bluing of surface, fusion of the wire, weld spatters
- damaged thimbles and ferrules - check secure and free from damage
- damaged connector - worn, distorted, cracked, burred, dented and has sharp edges

5.2 Detailed Inspection

These are the same as the pre-use checks carried out by a competent person at a set period (WAHSA recommends every 3 months). These checks must be documented and the documents kept.

5.3 Interim Inspection

These are additional detailed inspections. The need for and frequency of interim inspections will depend on the use and the environment. Examples of situations where they may be appropriate include: arduous working environments involving paints, chemicals, grit blasting operations and acidic or alkaline environments. The results of interim inspections should be recorded and kept.

6.0 Longevity and obsolescence of energy absorbing lanyards

Advice on obsolescence will be contained within the manufacturer’s user instructions. The frequency and conditions of use together with the quality of cleaning and storage will determine the safe and effective working life of personal protection equipment (PPE).

It is important that energy absorbing lanyards do not remain in use for periods which exceed the obsolescence date given by the manufacturer - or in cases of degrading environments, the lifespan specified by a competent person. For detailed guidance on inspection procedures, see WAHSA TGN03.

7.0 Cleaning and maintenance

When necessary, wash webbing with a mild soap solution (maximum temperature 40°C) and remove excess moisture with a clean cloth. Wiping with a mild solution of sterile disinfectant may disinfect the webbing. Allow to dry naturally.

Clean metallic items when required, with a non-caustic solution.

8.0 Storage

Store the single or twin energy absorbing lanyard in a dry, shaded, ventilated area away from direct heat.

9.0 Rescue

A rescue plan should be formulated for the rescue of a person with the required equipment and trained personnel to carry it out. (See WAHSA TGN05).

10.0 Training

WAHSA strongly recommend that all users of fall protection equipment are trained by a competent organisation. Training should include information on the selection of the correct products for intended work situation and pre-use checks for specific equipment.

11.0 Useful References

The Work at Height Regulations 2005

The Lifting Operations and Lifting Equipment Regulations 1998

BS EN 354: 2010 *Personal fall protection equipment – Lanyards*.

BS EN 355: 2002 *Personal protective equipment against falls from a height - Energy absorbers*

BS EN 358: 2000 *Personal protective equipment for work positioning and prevention of falls from a height - Belts for work positioning and restraint and work positioning lanyards.*

BS EN 361: 2002 *Personal protective equipment against falls from a height - Full body harnesses*

BS EN 362: 2004 *Personal protective equipment against falls from a height- Connectors*

BS EN 363: 2008 *Personal fall protection equipment – Personal fall protection systems*

BS EN 364: 1993 *Personal protective equipment against falls from a height - Test methods*

BS EN 365: 2004 *Personal protective equipment against falls from a height - General requirements for instructions for use, maintenance, periodic examination, repair, marking and packaging*

BS EN 795: 2012 *Personal fall protection equipment – Anchor devices*

BS 8513: 2009 *Personal fall protection equipment - Twin-legged energy absorbing lanyards - Specification*

BS 7883:2005 *Code of practice for the design, selection, installation, use and maintenance of anchor devices conforming to BS EN 795*

BS 8437: 2005 + A1: 2012 *Code of Practice for selection, use and maintenance of personal fall protection systems and equipment for use in the workplace.*

BS 8454: 2006 *Code of Practice for the delivery of training and education for work at height and rescue*