Rooftop Worker
Arqiva approved

DURATION
1 Day
COURSE REQUIREMENTS
Medically Fit
RATIO OF TRAINERS TO TRAINEES
Normally 1 to 6



Height Safety Training
Equipment Supply
Kit Inspection

XI Training Limited Unit 1 Keer Bridge Depot
Scotland Road Carnforth Lancashire LA5 9RQ
Tel: 01524 736510 Fax: 01524 720835

www.xitraining.co.uk

Rooftop Access

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Rationale

In the Offshore Industry sector, 30% of reported incidents, which resulted in injury, were due to slips, trips and falls from height. In all, 69 separate incidents. Those most at risk were found to be young workers, and the most hazardous areas of work were found to be those involving the use of mobile installations, maintenance activities, climbing, descending, working at height (above 2m) and drilling.

Some of the key direct causes were found to be poor P.P.E. and inadequate inspection / maintenance of P.P.E. . (*2002 Offshore Technology Report, STF's Offshore*)

In the construction industry 20% of work related deaths are caused by falls from or through roofs. Of these the biggest single cause is falls through fragile roofs such as roof lights and asbestos cement roof panels. These figures include the general public, notably children and construction workers. There is clearly a need to improve this safety record.

The Health & Safety Executive identified that the most effective preventative measures to tackle the range of issues involved, were training, risk awareness, developing a safety culture in the industry and challenging others.

Health & Safety Requirements

As with all other activities that take place at height, Roof Top Access and Exposed Edge Work are governed by the same pieces of legislation as previously outlined in the 'Health & Safety / Risk Management' section of the training course.

In addition to these the Construction Design and Management Regulations (1994) (CDM), place a duty on all designers to give adequate regard to health & safety. In particular there is an emphasis on designers to design out hazards where at all possible, taking account of the whole life of the structure including building, use, maintenance and demolition. There is also a clear preference for the provision of general rather than individual protection, which aligns well with the aim of the 'Hierarchy of Safe Systems'.

Roof Work Common Generic Hazards

Below are outlined some of the common generic hazards associated with roof and exposed edge working environments. They have been broken into five key areas for clarity.

- **Falls**
  - Access & Egress
  - Exposed Edges
  - Materials Handling e.g. Size, Shape, Position, Method
  - Lifting Operations
  - Fragile surfaces e.g. Roof Lights, Asbestos cement sheets
  - Trip Hazards e.g. Ducts, Piping, Cable Tray, Steel work, Rubbish
  - Slip Hazards e.g. Moss, Lichens, Water, Ice, Snow
  - Weather e.g. wind, lightening, poor visibility

- **Falling Materials**
  - Exposed edges
  - Materials handling
  - Management of tools and equipment
  - Lifting Operations – crane operations which may be ongoing at the same time
  - Waste Management

- **Health**
  - Manual Handling
  - Electricity e.g. Overhead power lines, Live Equipment
  - Radio Frequency Sources e.g. Antennas, feeder
  - Fumes and Harmful Gasses e.g. Vents, Exhaust Flues
  - Hazardous substances e.g. Asbestos, Lead, Asphalt, Bitumen, Glues, Solvents, Bird excrement.
  - Temperature extremes
  - Noise e.g. Sirens, horns, aircraft
  - Entanglement e.g. moving wires, gearing, lifting systems
  - Recovery from Fall Protection Systems e.g. Suspension Trauma

- **Fire Safety**
  - Are warning systems audible / visible
  - Are there emergency egress routes available

- **Lone Worker Systems**
  - What systems are available to monitor / supervise

Scope Of Activities

The scope of activities that take place on roof systems and by exposed edges is numerous, but will generally fall into one of the following categories:

- Construction / mobilisation
- Refurbishment
- Inspection
- Maintenance / Cleaning
- Dismantling / demolition / demobilisation

All of these activities will have similar hazards associated with them and should be dealt with in respect of risk assessment and control methodologies in the same way. Time duration on the roof or by the exposed edge will have very little bearing on mitigating the hazards present, although this is often a justification for a less rigorous approach.

Method Statements

Method statements are an essential method by which workers can be made aware of the hazards to which they will be exposed and what action should be taken to eliminate or manage them. Method statements should be written for the benefit of those carrying out the work and their immediate supervisors. They should be clear and unambiguous, and detail what equipment is needed and how changes to the working method should be managed. Simple sketches can be used to illustrate points.

A Method Statement should detail a range of the following dependent on the nature and complexity of the work being undertaken:

- Where the work will take place (position)
- Access and Egress routes to and on the roof
- What systems will be used to prevent or manage falls
- What systems will be used to control the danger of falling materials and tools on to other workers and the public.
- How other specific hazards identified in the risk assessment will be managed.
- What equipment is needed
- What level of competence is required
- What training is needed
- How the work will be supervised
- How changes to the working method should be made and checked

Hierarchy of 'Safe Systems' for Roof Top

When we consider Roof Top Access and Exposed Edge work this is generally, but not exclusively, taken to mean activities within 2m of a hazard or exposed edge. The process of deciding which system to use should be based upon balancing the hazards and risks identified against the cost inconvenience and practicality of the system. The decision making process should work through the following hierarchy and use the first system for which this balance can be justified.

Eliminate need for the person to be at height.

- Should the worker be there?
- Can the need be designed out?

Install Guarding to prevent access to the fall hazard area.

- Demarcation barrier / edge protection?
- Permanent / temporary?

Provide a Work Platform with barriers / guard rails.

- Fixed or mobile e.g. scaffolding, Mobile Elevated Working Platform (MEWP), cherry picker, scissor lift.

Provide a system of restraint.

- Permanent fixed system.
- Temporary rope or wire system.

Provide a system of suspension or work positioning.

- Rope access / bosuns chair.
- Work positioning pole belt.

Provide a system of Fall Arrest.

- Passive using netting / air bags.
- Active using PPE with a shock absorbing component and full body harness.

The level of inherent risk related to each subsequent system is greater, and relies increasingly upon a number of factors, particularly the ability of the end user to be effective. This is why the use of PPE should never be considered to be 100% effective and should always be considered as the LAST RESORT. The use of PPE requires a high level of training for the user.

Specifications Related to Demarcation Barriers

Where the exposed edge / fragile roof area is more than 2 m from the work area it is acceptable to provide a demarcation barrier to identify the work area and any route of access / egress. This would be placed at least 2m from the hazard.

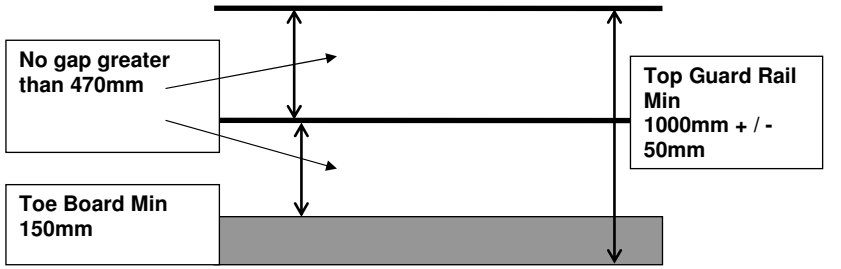
This system is only suitable for flat and gently sloping roofs and where there is adequate supervision / discipline. Some means of preventing materials from rolling away may be needed.

The barrier should be sufficiently durable and immediately obvious to all. Past systems of marking such as tape or painted lines at foot level are not acceptable.

Specifications Related to Edge Protection

As a basis all guarding that is installed to provide Edge Protection for work areas should meet the following minimum standards, although for some applications such as mobile platforms these standards will vary slightly:

- Strong and rigid enough to prevent a person falling / other loads likely to be placed on it.
- Main Guard Rail minimum of 1000mm (+ / - 50mm) above roof edge / edge from which a person is able to fall.
- Toe Board minimum of 150 mm high. For M.E.W.P.'s 100mm.
- Intermediate guard-rail or alternative which limits any unprotected gap to a maximum 470mm.



Specifications Related to Work Platforms

It may be necessary to provide a safe working platform where the roof is sloping sufficiently or where work is undertaken in the proximity of a fragile roof surface. The platform or staging should have a minimum width of 600mm.

For offshore applications there are a number of standards depending on whether the platform is being used for static work,(width 390mm, depth 460mm) whether the work requires plenty of mobility, (width 760mm, depth 920mm) and whether the platform is a walkway solely, (width 500mm) or is part of en emergency route (width 1100mm).

On roof valley gutters it may be necessary to include the provision of permanent or mobile side protection to prevent a person falling through adjacent fragile material. This would need to extend up to 2 m on steep roof gutters, further on more gently sloping roofs.

Specifications Related to Fall Arrest Netting

The application of fall arrest netting as a means of fall protection has advantages over PPE Based fall protection systems as it offers a greater degree of freedom to the workers and offers some degree of protection to those people working below.

All netting used for this purpose should conform to EN 1263, and wherever possible it should be installed as close to the underside of the working platform and always less than 2m below the roof surface to minimise fall distance.

Such systems must have an adequate clearance distance below and should minimise the total fall distance to a maximum of 6 m. The impact force on a falling person should be limited to a maximum of 6 kN.

Operational Systems which require the use of PPE

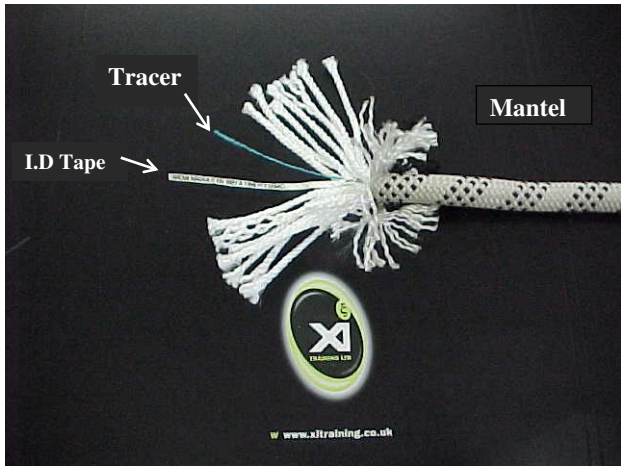
Clearly where there are 'Safe Systems' already available on a roof top or by an exposed edge, then if these are suitable they should be used, where their certification and maintenance can be verified. When this is not possible it may be necessary to either have a safe system designed and installed or to construct your own system from a selection of basic fall protection PPE such as ropes, connectors, slings, work positioning rope grabs and a full body harness.

The aim of any such set-up is to prevent the user from gaining access to the fall hazard area. In order for this to be effective a good understanding of how these components should be used is essential.

Rope

The standard rope for roof top access and exposed edge work set-ups is, 11mm, Low Stretch, Kernmantel, CE, EN 1891 A.

The rope is made up of a main load bearing inner (Kern) with a protective outer cover (mantel) together these two units perform as one rope.



This type of rope is available in plain white as standard, olive and black. Rescue kits contain a water-resistant treated rope in orange to the same standards. A fire retardant version is also available.

Rope lengths are available in multiple lengths of 1m, up to 200m as standard.
(500m as special order)

The maximum breaking strength of **new**, 11mm low stretch rope, is as follows;

Type	weight in g/m	max. break. Strength in kN*
11mm low stretch plain	**74g / m**	**35kN**
11mm low stretch coloured	**78g / m**	**32kN**
11mm low stretch firesafe	**80g / m**	**28kN**

** For ease of working 1kN = approximately 100kg (so 35kN = 3500kg = 3.5 tonnes)*

It is clear to see that adding colour / treatments reduces the strength slightly and increases the weight of the rope. E.g. 4g / m. (200m x 4g = 800g = 0.8kg)

This type of rope is marked at each end with the diameter, length, CE, EN, type and manufacturer.

CE 0120
EDELRID 100m
A 11
EN 1891

As markers on the rope ends can be easily removed a printed tape runs though the length of the rope with the following information, repeated at intervals of approximately 3cm; manufacturer, date of production, country of origin, EN standard, raw materials and rope type.

All rope should be stored dry and loose flaked into rope bags.

The life of a rope depends on its usage and condition, the maximum allowed number of descents varies between authorities.

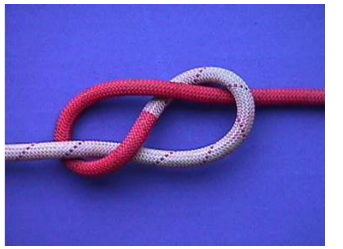
It must be noted that any rope that fails a PPE inspection, regardless of number of descents MUST be removed from service.

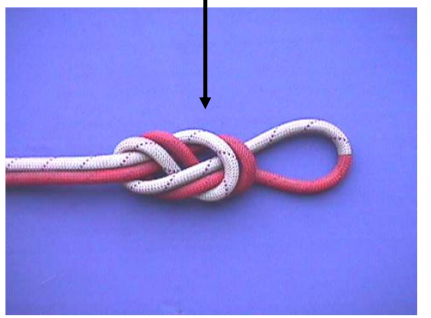
The manufacturers recommended life for a new rope is between 4 – 6 years, this may be reduced to a single use depending on damage and inspection.

Knots

Below are six knots that can be employed in roof top and exposed edge set-ups. Any Knot will weaken the rope, typically by between 15% and 45%. As a simple rule the tighter the bends in the knot the weaker it makes the rope.

Single Figure of Eight is used to form an end marker of a rope and can be tied with a bight of rope to form a **Double Figure of Eight**.





Rethreaded Figure Of Eight
Is use to secure a figure of eight to an enclosed object. To do this, start with a Single Figure Of Eight about 1-2m from the end of the rope. Pass the end around the object and then rethread the knot with the free end to form a **Double Figure of Eight**.

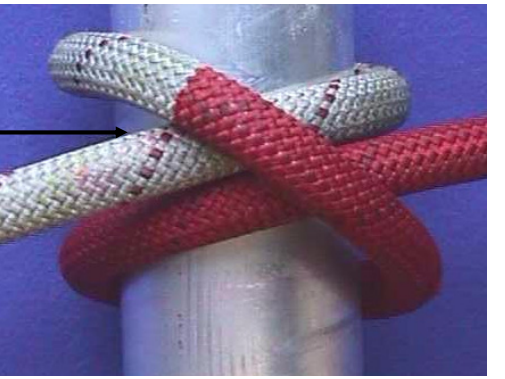


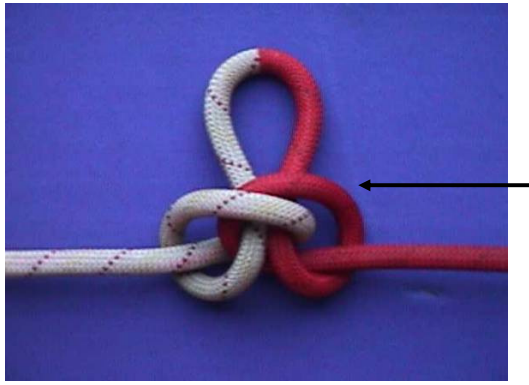
Stopper Knot is used to back up the Double Figure of Eight when in a situation where the rope is repeatedly loaded and unloaded. It minimises the risk of the Figure of Eight coming undone.



Figure of Nine can be used where more strength is required. Simply add another half turn before completing the Figure of eight.

Clove Hitch can be used to attach to an anchor with a round profile as this knot requires the surface contact to work effectively. It provides a very quick to tie and easily adjustable knot. Where possible this should be tied off with a couple of half hitches to ensure no slippage.





Alpine Butterfly provides an attachment point where a three-way load is to be applied. (Can be used temporarily to exclude a damage point on a rope.)

Connectors

These are often referred to as karabiners, krabs or screw links, they are made from alloy, mild steel or stainless steel.

There are any number of styles and types available; the only ones suitable for roped access are the screw gate variety, with a minimum breaking strain of 22kN.



The reason for the use of screw gates is to prevent accidental opening of the gate due to vibration, running ropes or contact with other items of equipment. Automatic locking gates (twist locks) are not suitable as they have a nasty habit of sticking with the safety gate open and only require a ¼ turn to open the gate.

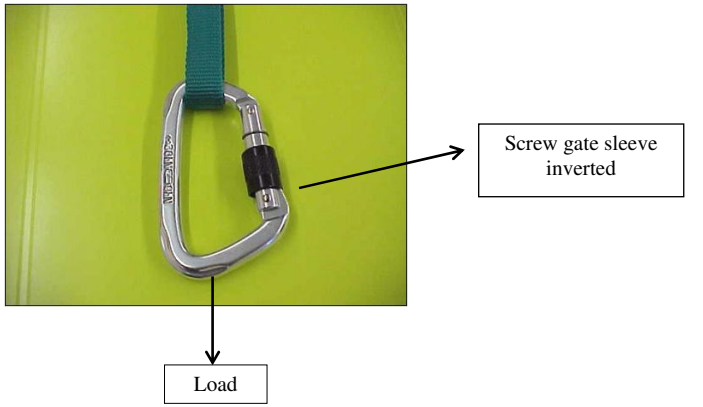
Screw link connectors are often used in caving for a semi-permanent connection; once closed they offer a very secure 'solid link'. Screw links are ideal for connecting items to harnesses that do not need to be removed once on the rope.

Screw links suitable for PPE must have the following information;

Test centre e.g. CE 0082
Breaking strain on main & cross-loaded axis in kN
Date of manufacture

Do not confuse with screw links designed for lifting which are marked with a WLL (Working Load Limit) or SWL (Safe Working Load).

All connectors should be inverted so that gravity will assist the gate to remain closed during operations. (Were possible).



The information stamped on a connector tells us the maximum breaking strain of a new connector. The markings usually show 3 directions of pull.
e.g. a 25 kN karabiner may display the following information.

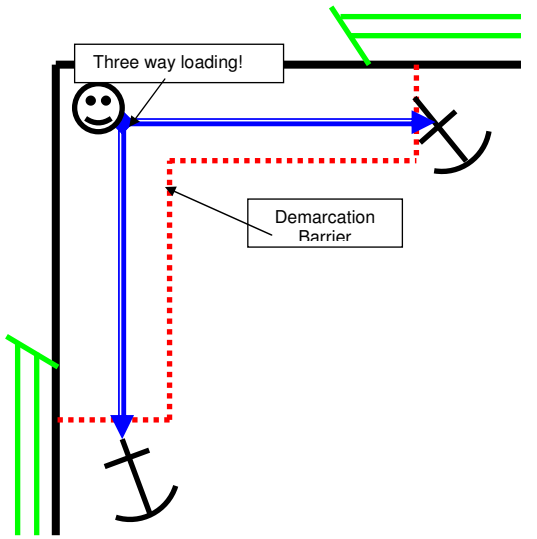
- Load along the main axis  25kN
- Load along the minor axis 8kN
- Load with the gate open  7kN

Note the massive reduction in strength if the connector is not loaded correctly along the main axis. However, 8kN are approximately 800kg or about 10 people! So why is it so important?

Think back to our falling person of 80kg, falling 4m and generating 18kN (1800kg) a 1000kg more than the breaking strain of a cross-loaded connector. This is the reason that all connectors must be loaded along the main axis.

Example

Below is a simple example of a roof top set-up to protect the worker from two exposed edges along with some edge protection and a demarcation barrier 2m from the exposed edge. Once within the exclusion zone an operative PPE system must be in use.



Anchors

Selection of appropriate anchors is critical to a system working effectively. It is also the one which commonly causes most difficulty because of a general lack of them on roof top sites. There are a number of options available;

- Existing steel or masonry work on the roof top if it is sufficiently strong (beware of chimneys which are notoriously fragile).
- Placing your own expansion or resin bolts if there is a suitable fixing point.
- Using a mobile man anchor to attach to which is free standing and can be brought on to the roof in small pieces and assembled.

Some examples of roof top systems in use



