TRA1U – ISO Rope Access Technician

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TRA1U ISO Rope Access User

Contents

Continued Overleaf

Divergence Angles in Multiple Anchor Systems

Elementary Rigging Methods

Attachment Configurations for Slings & Strops

Rope Edge Protection

Edge Protection Hierarchy

Selection of Edge and Rope Protectors

Passing Mid Rope Protection

Edge Obstructions at the top

Use of a Workseat

Rescue Procedures - General Considerations

Basic Rescue Technique

Rescue of a Person in Descent Mode - 2 Sets of Ropes

Basic Hauling

Z-Rig Hauling and Tensioning

Typical Arrangement of a Lowering Line

Example of rigging for rescue in rope access

Equipment for Rope Access

ISO Rope Access Summary

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BS ISO 22846 – An international standard covering the fundamentals of rope access

Synopsis

heightec has been involved closely in the development of both parts of ISO 22846, *Personal equipment for protection against falls – Rope access systems*. There are many factors essential to the safety of a rope access system and a failure or shortcoming in any of them can render the entire system deficient. The Standards offer a comprehensive and international benchmark to measure the compliance and effectiveness of rope access systems.

Background

ISO 22846 has its roots in the late 1990s, when a work item in ISO/TC94/SC4[1] enabled a working group (WG6) to commence a project to produce a Standard containing advice and guidance for rope access systems.

ISO 22846 was planned as a single document and much of the first draft was based upon BS 7965: 2002[2], which in turn had been based upon the IRATA[3] *Guidelines*[4] (2002). A later draft of ISO 22846 formed the basis of the current IRATA *International code of practice* (2014), which superseded their *Guidelines*.

Two Parts

BS ISO 22846 comprises two parts[5] under the general title, *Personal equipment for protection against falls – Rope access systems*:

- Part 1: *Fundamental principles for a system of work*
- Part 2: *Code of practice*

ISO 22846-1[6] was published in 2003 (being adopted as a British Standard in July 2012[7]) and gives the fundamental principles for the use of rope access methods for work at height. It is applicable to the use of rope-access methods on buildings, other structures (e.g. on or offshore) or natural features (e.g. cliff faces), during which ropes are suspended from or connected to a structure or natural feature; and is applicable to situations where ropes are used as the primary means of access, egress or support and as the primary means of protection against a fall.

ISO 22846-2 was published much later, in 2012 (with immediate publication as a British Standard[8]). It expands on the fundamental principles outlined in ISO 22846-1 and gives recommendations for:

- planning and management;
- operative competence and responsibilities of personnel;
- supervision;
- the selection, use and care of equipment; and
- advice on how to implement a 'safe system of work'.

There may be other issues to consider also, depending upon the nature and location of the work, the competence and experience of the operatives (as well as local or regional legal requirements).

1 Technical Committee ISO/TC 94, *Personal safety – Protective clothing and equipment*, Subcommittee SC4, *Personal equipment for protection against falls*

2 BS 7985: 2002, Code of Practice for the use of rope access methods for industrial purposes, Published: February 2002 (replaced by BS 7985: 2009)

3 Industrial Rope Access Trade Association (now IRATA International), www.irata.org

4 Guidelines on the use of rope access methods for industrial purposes, IRATA

5 Resolution passed at the ISO/TC94/SC4 Meeting, Sydney, May 2001

6 ISO 22846-1: 2003 Personal equipment for protection against falls – Rope access systems – Part 1: Fundamental principles for a system of work, http://www.iso.org/ (March 2009)

7 BS ISO 22846-1: 2003, Personal equipment for protection against falls – Rope access systems – Part 1: Fundamental principles for a system of work, http://shop.bsigroup.com (July 2012)

8 BS ISO 22846-2: 2012, Personal equipment for protection against falls – Rope access systems – Code of practice, http://shop.bsigroup.com (March 2012)

LOLER Regulations

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The Lifting Operations and Lifting Equipment Regulations – LOLER

LOLER came into force in 1998. These Regulations apply to all lifting operations at work, ranging from the suspension of persons to the lifting of a bucket of cement. They do not specifically apply to fall protection equipment, but apply where such equipment is used for lifting.

LOLER has links to other legislation such as PUWER and MHSWR, both of which have other requirements for the use of work equipment (lifting equipment). PUWER requires proper information, and training for users, MHSWR requires an assessment of risk and use of appropriate control measures. Key requirements are as follows:

Application – Reg 3

Equipment must be suitable for the intended purpose, bearing in mind the conditions in which is will be used and the possible risks to the health and safety of users. An assessment should be made of likely risks and potential harm to users.

Strength and stability – Reg 4

Every part of a load and anything attached to it and used for lifting it must be of adequate strength. Particular regard should be paid to stress at the mounting or fixing point.

Lifting equipment for lifting persons – Reg 5

Steps must be taken to prevent such equipment causing injury or harm to the person using it.

Positioning and installation – Reg 6

Equipment or loads should be positioned so as not to cause harm by moving unintentionally or by the load being released.

Marking of equipment – Reg 7

Machinery and accessories for lifting must be clearly marked to indicate their safe working loads.

Organisation of operations – Reg 8

Every lifting operation must be properly planned by a competent person, appropriately supervised and carried out in a safe manner. Arrangements should consider the load to be lifted, the position of the load before and after the lift, methods to prevent the load from falling, how the equipment will be used, the site of the operation and the competence of the persons carrying out the operation. Loads should not be suspended over areas occupied by persons.

Thorough examination and inspection – Reg 9

Lifting equipment subject to deterioration must be thoroughly examined by a competent person in accordance with a specified schedule or at intervals no greater than 12 months (6 months for equipment used for lifting persons. The results of the examination must be recorded.

Reports and defects – Reg 10

If a person making a thorough examination encounters a defect, the employer should be notified immediately, with a written report made as soon as reasonably practicable.

Keeping of information – Reg 11

Records of thorough examinations or inspections should be kept for a minimum of two years, or until the next report is made, whichever is later.

Rope Access Equipment Set-Up

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This is the recommended arrangement of harness equipment for a rope access technician.

Cowstails are often referred to as "Device Lanyards" or "Anchor Lanyards" (IRATA ICoP Part 2.7.8.2 September 2013).

Back Up Devices

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Back-Up Devices

The back-up device should be used to protect against falls before, during and after attachment to the working rope. It should be the first item to be attached and the last item to be removed during all ascending and descending activities.

There are three models of back-up device commonly used in rope access operations; the Petzl Shunt, the SAR Rocker and the Petzl ASAP.

Different devices are preferred by different users according to their characteristics and methods of use. In all cases, it is important that all falls are kept to a minimum, so wherever possible position the back-up device to prevent slack developing in the connecting lanyard (and never below waist level). Handle the backup devices during use as little as possible. They should preferably be moved by holding the attachment karabiner, not the body. Some models can be pulled down the rope in the event of a fall if the body is held by the user.

The ASAP

This device remains in place above the user on the rope and can follow them down without action on their part. Great care is required if used with high loads and must be used with appropriate energy absorber (loads above 100kg must only use Absorbica (L57). May not lock on low impact falls on slopes.

The Rocker

This device hangs on the safety line suspended by its own lanyard. Some versions can be manually fixed in a higher position on the rope.

The Shunt – No longer recommended

The Shunt was used as a back-up device for many years and, until recently, was the most widely used device. It was an economical and versatile product, although it had a drawback in that it must be pulled down the rope by the user. This raises the possibility that the device may be pulled all the way down the rope in the event of a fall and this has happened in rare instances; reasonably foreseeable misuse.

Although it was possible to move the Shunt down the rope by means of the attachment karabiner, it was traditionally moved by means of a small cord attached to the device. This had to be as short as practical to allow the device to be operated. The chord – held loosely to maximise the chances of letting go in the event to a fall – should not have a loop tied for a finger to be inserted.

The safest method of operation to reduce the possibility of uncontrolled descent was to move the descender and backup device independently, e.g. descend a short distance down the rope without moving the device, remove the operating hand from the descender then move the back up device down independently.

For long descents it was customary to hold the cord of the back up device between the ring and little finger of your left hand in conjunction with operating the descender handle.

If a fall does occur whilst a Shunt is being held, it is critically important to let go – although this is very difficult in practice.

A statement released by Petzl in August 2014 recommended NOT to use the Shunt while towed by a cord as a back-up in rope access:

http://www.petzl.com/en/Professional/News/2014-8-5/Petzl-statement-special-use-petzl-shunt?l=INT#.VMJ58UesUQN

IRATA quickly responded with its own statement, which makes Shunt usage very unpractical: www.irata.org

Following these statements Shunt usage in rope access started to decline, with most companies preferring to use back-up devices that conform to the appropriate standards, such as the Petzl ASAP and heightec Quantum.

Critical Safety Measures in Descenders

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Critical safety measures in descenders

Although rope access has an excellent safety record, accidents have occurred; usually because of operator error and often when tools are being used. Uncontrolled descent is one of the most likely causes of accidents.

It is impossible to emphasise enough the importance of using the descender and back-up device correctly and for the need for redundancy in the suspension system, e.g. users always have at least two independent connections to an anchor point – a means of support and a back-up.

Descenders

Three types of descenders are commonly used at the moment for rope access; the Petzl Stop, the Petzl I'D and the Petzl Rig.

Auto-braking means the device will lock or slow if the handle is released or not operated.

Double action means the device will auto-brake and will also lock if the handle is squeezed too hard in panic.

The Prism
This relatively new device is auto-braking and double action. It does not require an additional braking karabiner for rescue loads as this feature is incorporated into the device.

The Petzl Stop
The Stop was originally designed as a descending device for recreational caving. In the 1980s it was adopted into the rope access industry and has always been the favoured descending device. Although it is arguably not the safest device on the market, it is the cheapest. The Stop is auto-braking but not double action. It is relatively easy to control but can slip with heavy loads or thinner ropes. An additional karabiner is required for rescue loads.

The Petzl I'D
This device is specifically designed for industrial rope access use. It is auto-braking and double action. It requires and additional braking karabiner for rescue loads or when used as a lowering device.

The Petzl Rig
The Rig looks like a smaller version of the I'D and is cheaper than the I'D. It is auto locking but not double action. A high level of competency and great care must be taken when using heavy loads, such as rescue. It also requires an additional braking karabiner for rescue loads or when used as a lowering device.

Using descenders – general

Although descenders incorporate auto-braking features, they should never be regarded as being able to overcome operator error.

Never let go of the tail rope, even momentarily. The descender must always locked off before the tail rope is released.

Use descenders with respect. Descend slowly and in control. High speed, bravado descending can lead to an accident. If descending with an additional load, e.g. with a casualty, some descenders may require additional friction to be added, by using a karabiner, for example.

Take extra care when using descenders for ascent – during ascent the handle may be prone to being knocked or pressed by mistake, which would prevent the device from locking on the rope.

Method for Descending

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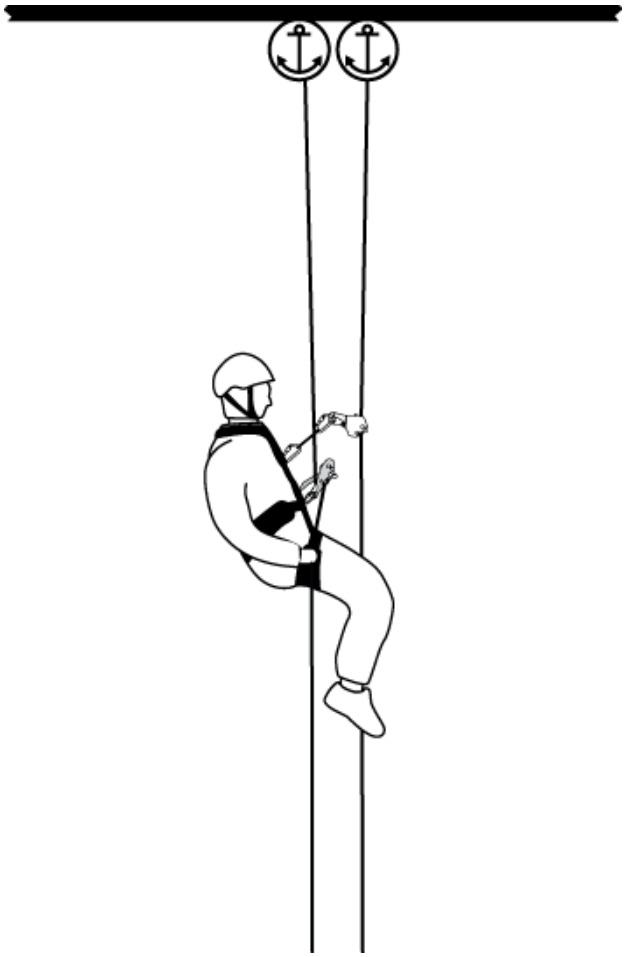
See BS 7985 (Informative annex):

1. Approach the area of descent safely, using additional fall protection if necessary.
2. Place the back-up device on the safety line and position it to minimise any fall.
3. Function check back-up device to ensure it is rigged the correct way up.
4. Thread the descender onto the working line, check security and operation then lock the descender.
5. Disconnect from the additional safety system (if used) and move to the point of descent.
6. Position for descent and move the back-up device to a position where it can be operated conveniently.
7. Control the “tail” rope leaving the descender and remove the lock on the descender.
8. Descend carefully and slowly, controlling the speed of descent by means of the descender.
9. Never lose control of the “tail” rope leaving the descender.
10. Always lock off the descender during stops in the descent.
11. Ensure the back-up device is operated with minimum slack in the connecting lanyard.
12. When the working position is reached, lock off the descender and position the back-up device as high as possible.



Descent Using Ascenders (Short Distances)

1. Start position is in ascent mode
2. Sit in harness and place hand ascender just above chest ascender
3. Stand in footloop and release cam on chest ascender by holding open the cam by pressing down on top of the cam using a finger. Move down about 30cm the release chest ascender cam.
4. Move hand ascender down and repeat process

Note – Use a finger pushed down between the ascender cam and rope to release. **Do not** fully open the cam catch.

Method for Ascending

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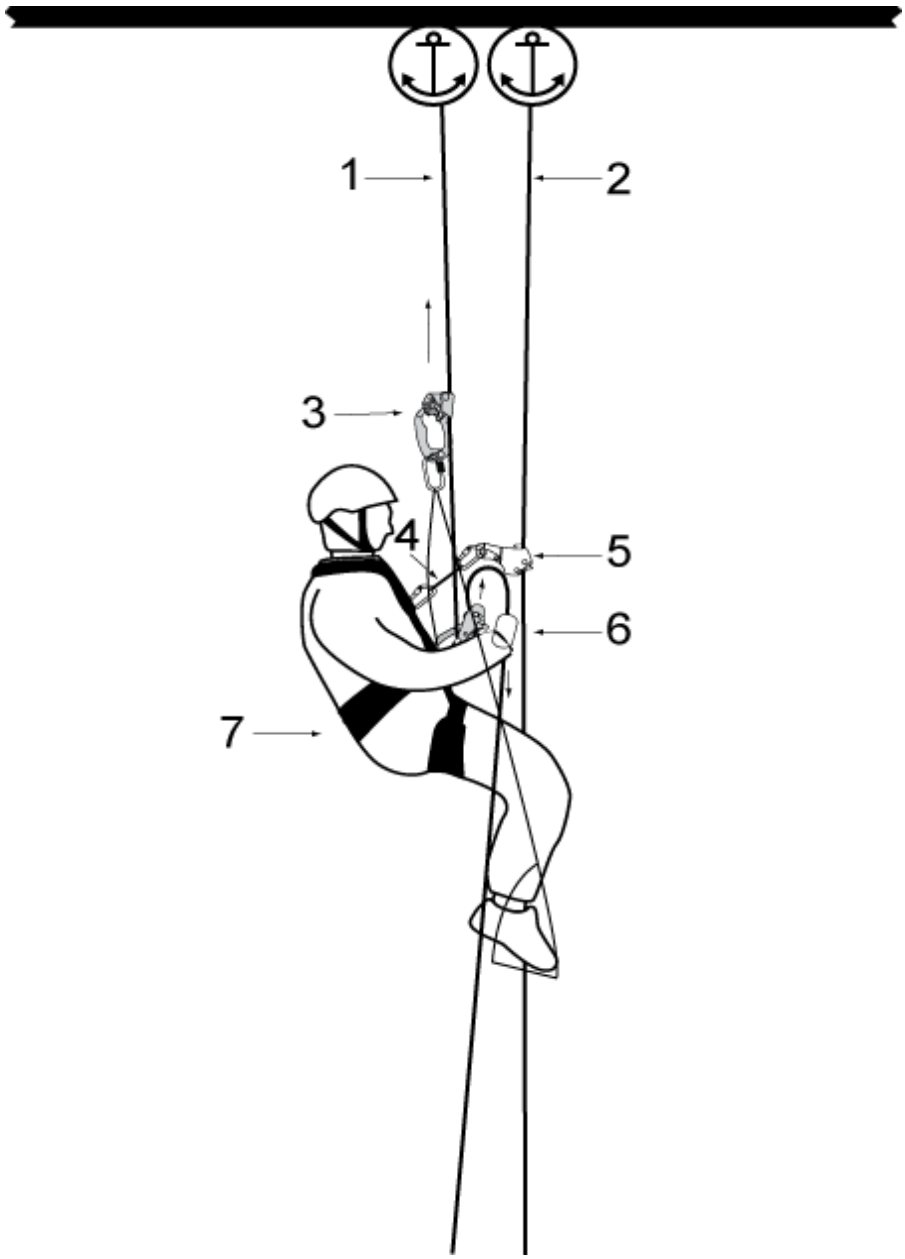
1. Approach the point of ascent using an additional fall protection system if necessary.
2. Check all rope adjustment devices and connectors for security.
3. Place the back-up device on the back-up rope at shoulder height.
4. Function check back-up device to ensure it is fitted correctly.
5. Fit the working rope to the chest ascender and take the initial stretch out of it by pulling it down through the chest ascender.
6. Fit the hand ascender above the chest ascender and by standing in the foot loop, pull through any further slack, passing the slack also through the chest ascender until the line is as taut as possible.
7. To begin the ascent, sit down on the chest ascender and lift the hand ascender to approximately helmet height.
8. Stand up in the foot loop and pull the resulting slack through the chest ascender as before.
9. Sit down, so the load is again taken on the chest ascender. Repeat this process until the ascent is completed.
10. Move the back-up device up the safety line during the ascent, taking care to avoid slack in the connecting lanyard (particularly when using close to ground level).
11. On reaching the top of the climb, attachment to a secure anchor or safety system.
12. Remove the chest ascender from the rope first, then the hand ascender.
13. When a position of safety has been reached, remove the back-up device.

NOTE:
It is essential that ascenders are only used in tension on the rope and that they are never used in such a way that they could be subjected to a dynamic load (the force of a fall). A fall onto toothed ascenders could result in rope damage.

Ascent Using Descender

1. Position in descent with locked descender and back up positioned correctly
2. Attach hand ascender to working rope above descender
3. Pull up on descender tail rope and stand up in footloop simultaneously
4. Sit down on descender and reposition hand on tail rope near descender
5. Raise hand ascender and repeat stand/sit procedure
6. Change to descent again by locking descender and removing hand ascender from working rope.

Alternative:



Key:

1. Working line
2. Safety line
3. Hand ascender and footloop
4. Cowstail
5. Back up device
6. Descender
7. Harness

1. As above, but put a small pulley into the bottom attachment of the hand ascender
2. Pass the descender tail rope through the pulley
3. Pull down on the tail rope when ascending

This method uses half the effort to climb.

Changeover from Ascent to Descent & Vice-Versa

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Changeover from ascent to descent and vice-versa

Descent to ascent

1. Place the back-up device as high as possible and lock off the descender.
2. Place hand ascender as high as possible above the descender.
3. Stand in the foot loop and place the chest ascender between the descender and hand ascender.
4. Remove the descender from the rope and ascend.

Ascent to descent

1. Attach the descender below the ascenders.
2. Pull the slack rope through the descender, so there is minimal slack between the chest ascender and descender and lock the descender off.
3. Place hand ascender 30cm above descender, or around face level, stand up holding both ropes high above hand ascender and back-up device, remove the chest ascender then lower weight gently down onto descender.
4. Remove hand ascender, unlock descender and descend.

NOTE:
Take care not to leave the hand ascender too far up the rope before commencing this manoeuvre, otherwise you may be hanging in tension from it afterwards.

Passing Deviations

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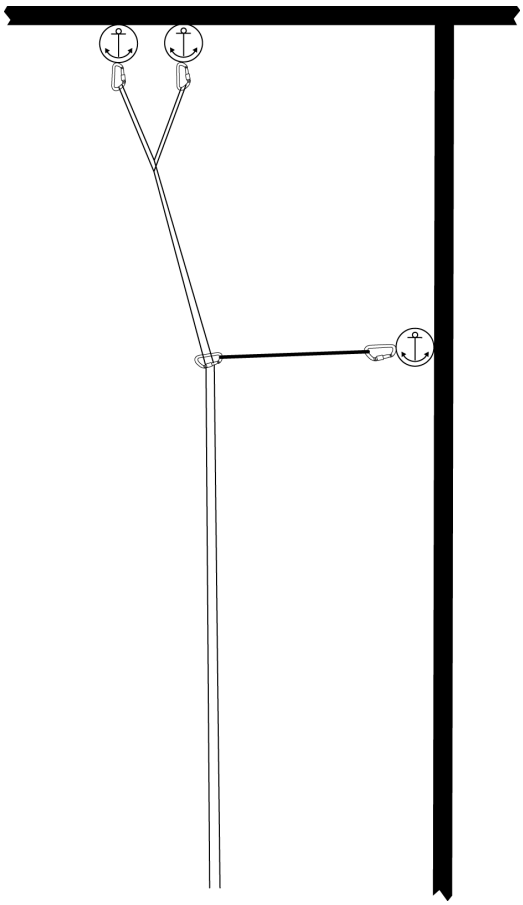
These are used below the main anchors to adjust the position of the rope sideways, to avoid abrasion or gain access to the correct work position. They can be fixed or adjustable and need not be load bearing. They are usually a sling or rope attached with a karabiner around the main ropes to pull the rope sideways by a small amount (20 degrees max.).

Passing a deviation with 1 karabiner in ascent

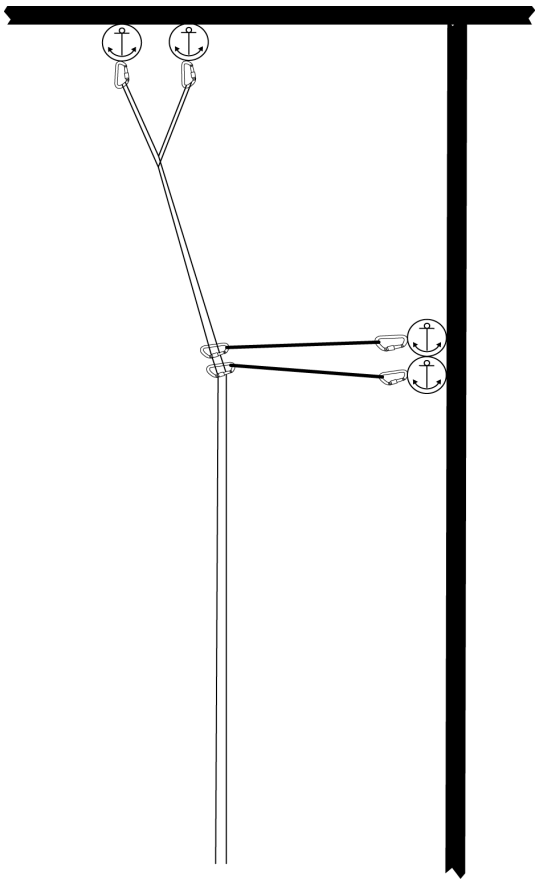


1. Ascend until head is level with the deviation anchor
2. Clip a cowstail into the anchor karabiner, so as not to move away from it
3. Remove the ropes from the deviation karabiner
4. Replace the ropes into the deviation below all ascenders
5. Remove the cowstail and carry on ascending

Passing a deviation with 1 karabiner in descent

1. Descend until head is level with the deviation anchor, lock descender
2. Clip a cowstail into the anchor karabiner (as above)
3. Remove the ropes from the deviation karabiner
4. Replace the ropes into the deviation above the descender and back-up device
5. Remove the cowstail and carry on descending

Passing a deviation with 2 karabiners in ascent



1. Ascend until head is level with the deviation anchor
2. Attach a cowstail to both anchor karabiners
3. Pull in towards the anchor karabiners and remove ropes from the deviation karabiners and replace below, one at a time
4. Lower out from deviation slowly and in control by holding deviation with both hands to avoid any out of control swing.

Passing a deviation with 2 karabiners in descent

1. Descend until head is level with the deviation anchor, lock descender.
2. Pull into the deviation and clip a cowstail into the into the anchor karabiners
3. Unclip both ropes from ropes under the descender and back-up device and replace above, one at a time
4. Unlock descender and descend

Rope to Rope Transfers

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If the work area spans a large horizontal distance, pairs of ropes may be set up across or underneath the work area to allow the operative to transfer from one pair to another. This method can allow work to be done across a wide area or above a water hazard, such as underneath a bridge or oil rig.

It is essential to be attached to all four ropes simultaneously during a rope to rope transfer, i.e. four points of contact are required. This is to avoid the risk of a pendulum swing or shock loading of the back up ropes in the case of failure of one of the working lines.

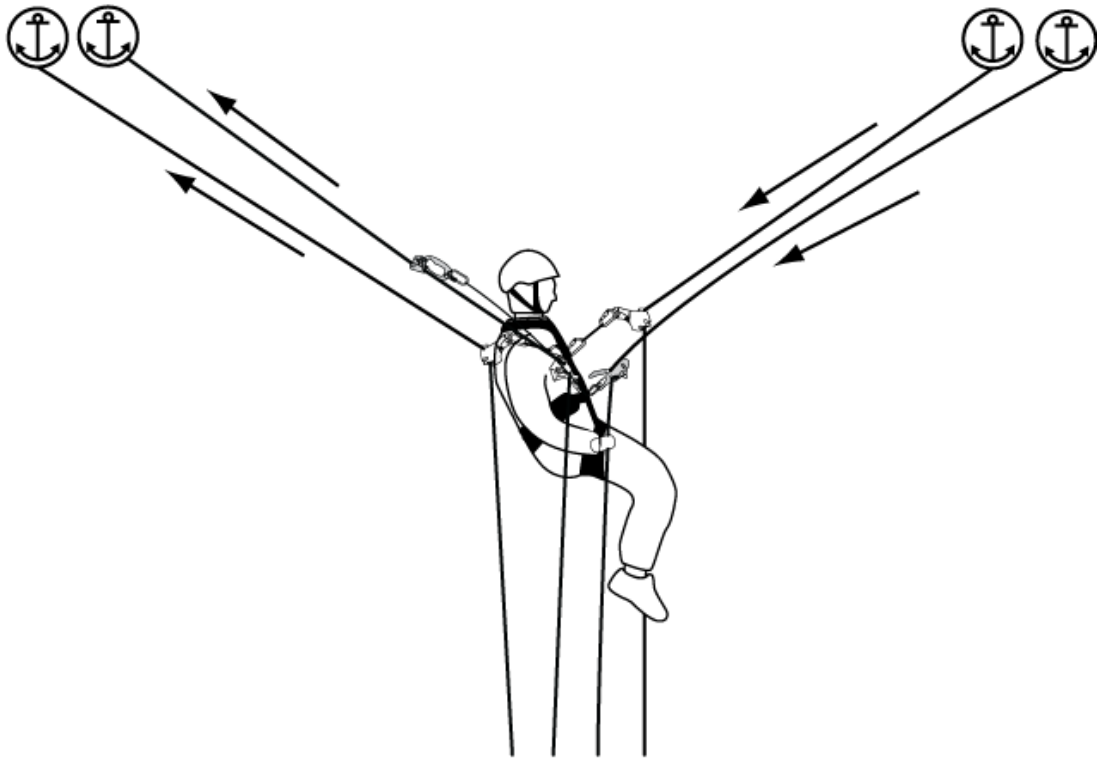
Method of transfer

This procedure should be done from the descent position. If the operative is in ascent they must changeover to descent prior to beginning to transfer!

1. Lock off the descender and reach across to the new ropes.
2. Place one rope in chest ascender and pull through the slack.
3. Tie an alpine butterfly into the other new rope at waist level and clip a long cowstail into this to provide the backup system (or use an extra back-up device if available).

NOTE: Alternatively use a second backup device on the new rope adjacent to the descender.

4. Descend down the old ropes until tension is taken up on the new ropes.
5. When installed on the new ropes, remove descender from old rope.
6. Transfer back-up device to new rope, preferably above the alpine butterfly.
7. Disconnect the short cowstail from alpine butterfly and then untie alpine butterfly.



Anchor Systems for Work at Height

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Selecting an anchor point

Anchors should be unquestionably reliable. They are the ultimate point connection point of any fall protection system. Anchors for fall arrest purposes may have to take the significant load of a person falling. The minimum strength recommended is 15kN (1500kg) – equivalent to the weight of a car, or 15 people.

Anchors for restraint systems can have a lower strength but must be able to withstand three times the person's weight. The minimum strength required for these is, therefore, 300kg.

Height and position

- Always use anchors which are in a position to give support from behind or above the working area (although not necessarily vertically above).
- The anchor point should ideally be in a 'safe' area, i.e. away from the edge.
- Beware of the sling or connector sliding or moving when the system comes under load.
- Position anchors to avoid pendulum swings over gable ends and along edges.
- Anchors used to attach fall arrest systems must provide sufficient clearance to prevent the user hitting the ground or structure in the event of an energy absorber deploying.

Correct (left) and incorrect (right) use of a connector on a structural anchor

Permanent anchors

Permanent anchors, e.g. eyebolts, fixed rails and wires, are specifically positioned and constructed for fall arrest anchorages. These anchors can be used for connecting a rope access system as long as independent anchors are used for each line.

Permanent systems are expensive to install and maintain, so will only be placed in commonly used areas. These anchors are generally considered reliable, as they have been fitted and annually re-inspected by a competent person.

PPE Eyebolts

Look at the identification disc to make sure it is within the inspection period. If it is out of date or doesn't have a disc, don't use it and advise the site owner.

- Carry out a pre-use check to make sure it isn't damaged or deformed and that it isn't loose.
- Check that the position is suitable for your use.
- Work below the eyebolt to minimise the fall distance.
- Make sure that the connector you are using will fit into the eye properly and load it in the correct plane.

Typical EN795 (Type A) Eyebolt

NOTE – Previously referred to as Class A

Fixed rail and wire systems

These are fitted to commonly used areas to provide a mobile connection for a fall arrest lanyard.

They can be horizontal, angled or vertical and are fixed directly to the fabric of the building or structure. Sometimes, more than one person can use these at one time.

Ask the site owner for a copy of the user instruction before using.

Connection is through a trolley that is usually left in place on the rail/wire. If not, check that you are using the correct type for the system and you know how to fit it.

Horizontal systems allow the user to freely follow the rail/wire along its length. Ends and junctions will have special fittings to stop the trolley coming off.

Inclined or vertical systems have locking trolleys that allow movement but will lock in the event of a fall.

Check the system is within the inspection period before use; ask the site owner if the information is not visible.

Check the system for obvious damage or looseness before use.

Report any damaged or out of date systems to the site owner.

Structural steelwork and masonry

In the absence of purpose built artificial anchors, structural steelwork provides one of the strongest anchors available. Preferred steelwork includes substantial support beams or columns, although welded steel handrails, supports for heavy machinery and large diameter pipes may also be considered.

Care should be taken to ensure that:

- The edges of steelwork are effectively protected.
- Handrails are solidly fixed in place and anchors are secured around the base to reduce leverage.
- Lightweight or corroded metal and cast iron is avoided.

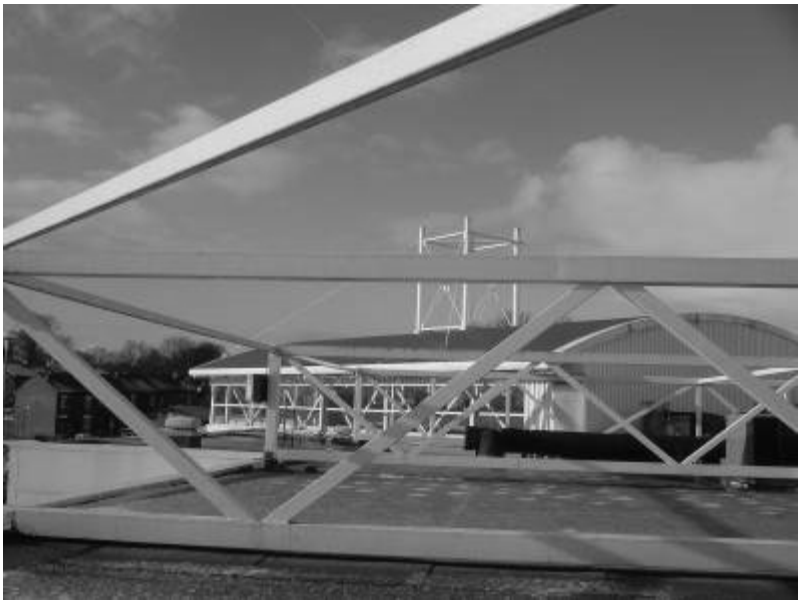
Where structural steelwork is not available, structural masonry such as reinforced concrete beams or columns may be effectively used. Care should be taken to ensure they are of adequate size and that edges are protected to prevent abrasion.

Connection to these types of anchorage is usually with a wire or webbing sling.

This sling is taken around the structure and clipped through the eyes using a screw-gate karabiner or other connector.

Wire slings are made in various lengths of 7mm diameter galvanised wire rope fitted with plastic sleeving to improve handling, grip and durability.

Webbing slings are made of a sewn loop of 25mm webbing of various lengths, they need extra protection around them if the anchorage has sharp edges.



Anchors - Rope Work

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Anchors – Rope work

An anchor can be defined as a safe point to which a load may be securely attached. An anchor system includes the anchor and the equipment used to connect it to the load, or the rope supporting the load. In all cases the anchor system provides the foundation of any rope system and must be unquestionably reliable.

Selection of anchors

When choosing anchors be careful to match the location, size, strength and number of anchors required with the forces that the task might place on the system. Anchors should be selected so that their maximum strength lies in direct opposition to the anticipated loading. In some cases the selection of anchors will be a matter of judgement based on training and experience. In cases of doubt err on the side of safety. It is better to incorporate too many anchors than too few.

In establishing a safe anchor system, consideration should be given to:

- Attachment to anchors
- Backing up anchors
- Anchor redundancy.
- Equalisation of anchors.
- Equalising knots and slings.
- Behaviour of the system following failure.
- Divergence of angles in multiple anchor systems.

Attachment to anchors

Consideration can be given to attaching rope directly to certain types of anchors, for example, around structural concrete, but this may have a detrimental effect on the long-term durability of the equipment, e.g. the rope. In general, where a connector such as a karabiner or screwlink cannot be attached directly to the anchor, a sling or strop should be used. When attaching with webbing slings be aware that looping the sling through itself should be avoided, as this will reduce the strength of the sling. Slings must be joined using a suitable connector and not choked together.

The rope system should be connected taking care to minimise any side loading or leverage on the anchor. When setting up a multi-point anchor system, the use of a rigging plate should be considered as this provides a well laid out and easily checked system.

Backing up anchors

Failure of a single anchor should never result in complete failure of the system. At least two anchor points should be always be used, configured so as to back up each other (anchor redundancy). Secondary anchor points must be as strong as the primary anchor point. Do not use multiple poor anchors in an attempt to create a strong anchor system.

Using structural anchors

In the absence of purpose built artificial anchors, structural steelwork provides one of the strongest anchors available. Preferred steelwork includes substantial support beams or columns, although welded steel handrails, supports for heavy machinery and large diameter pipes may also be considered. Care should be taken to ensure that:

- Edges are effectively protected.
- Handrails are solidly fixed with anchors fixed to the base supports to reduce leverage.
- Pipework is adequately secured and of suitable strength and is neither excessively hot nor cold. Insulated pipework should never be used, as the insulation masks the true size and condition of the pipe and could also compress under load.
- Lightweight or corroded metal and cast iron is avoided.
- Masonry is substantial and solid throughout the structure

Wherever structural steelwork is not available, other structural elements (e.g. reinforced concrete beams or columns) may be effectively used. Care should be taken to ensure that they are of adequate size and that edged are protected to prevent abrasion. Exercise caution with fixings secured in masonry and blockwork.

Specialised anchors

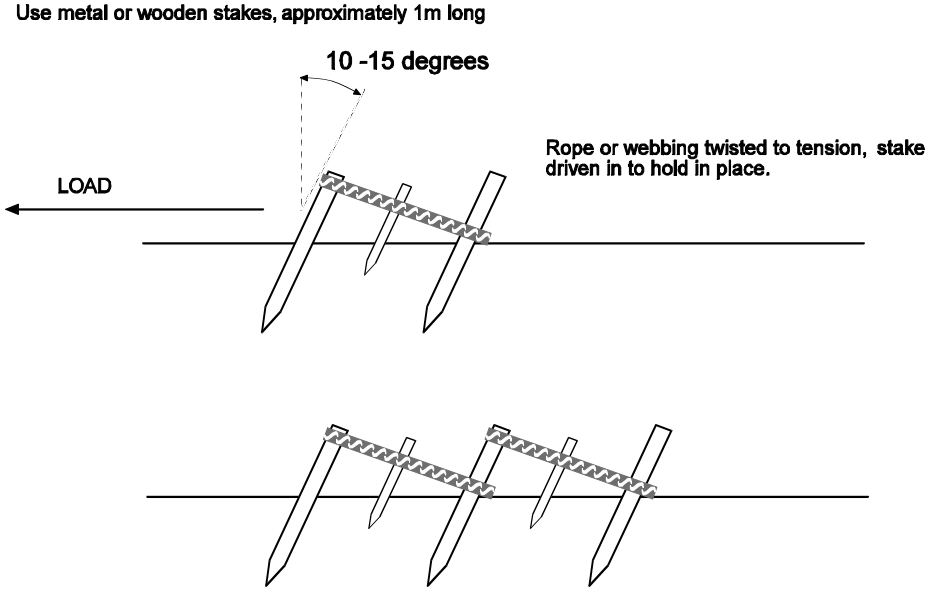
Ground anchors

Ground anchors may be constructed using round metal bar stakes, 'L' or 'T' section 'angle iron' stakes, or a variety of purpose designed ground plates that can be used either alone or in combination. Stakes should be inserted to their optimum depth and angled away from the anticipated load at approximately 15 degrees back from the vertical. Tests have shown that when using 'angle iron' as ground stakes, maximum benefit will be achieved by placing the stakes so that the closed edge of the 'L' points towards the load. This will transfer the load to the maximum area of ground contact.

When using stakes as ground anchors, especially when working in soft ground where the potential of an individual stake failing is high, it may be necessary to combine a number of stakes to form a single anchor unit. This may be achieved by linking the stakes with slings so that they function as a single unit, commonly known as a 'picket'. Where this is done, the connection between the first and subsequent stakes needs to be as tight as possible in the initial construction of the anchor system. If this is not done, there is a possibility that when the load is applied it will loosen the first stake and render it useless, resulting in a general weakening of the system with the potential to cause progressive collapse of the entire anchor.

Care must be taken to ensure that the load is not allowed to deviate from the direct line of the lead stake, as this will greatly reduce the effectiveness of the anchor. Where this is likely, the stakes should be arranged in a V-configuration to lessen the effect. An alternative method of constructing a combined anchor is by using a metal anchor plate.

Picket ground anchors



Natural anchors

Natural anchors can be described as those furnished by the terrain such as trees and rocks. Care must be taken when selecting natural anchors to ensure that they are substantial and that they are capable of supporting the intended load. In particular, the following points should be considered:

- Rocks and boulders should be assessed prior to being placed under load.
- Trees must be examined carefully to ensure that they are alive, in a sound and healthy condition and deep rooted.
- Special care should be taken with trees that are growing in shallow soil, such as is found near the edges of cliffs and quarries as they may have inferior root systems.
- To be considered as a reliable anchor, a tree should have a minimum trunk diameter of 15cm and anchors should be secured around the base to reduce leverage.

Artificial Anchors

Artificial anchors are those specifically positioned to provide an attachment to which ropes may be secured and can be further divided into:

Permanent artificial anchors

Permanent artificial anchors such as eyebolts are those that are left in place when not in use. These anchors are generally considered reliable, as they have been specifically positioned and constructed for anchorage purposes. They must be proof tested before use and must be checked on a regular basis both prior to and during use to ensure continued safety.

Temporary artificial anchors

Temporary artificial anchors such as vehicles, ground stakes, steelwork or climbing aids, are objects utilised for anchorage only for the period of use. In many cases they will have other primary functions but their size, weight or location allows them to be used as anchors.

Vehicles as anchors

Where no other suitable anchor is readily available, a motor vehicle can be considered for use as an anchor. When using a motor vehicle the following points should be considered:

- The vehicle should be placed on firm level ground.
- The handbrake must be fully applied and the wheels chocked at both front and rear.
- The vehicle should be placed in gear, the ignition keys removed and the vehicle locked.
- If the vehicle cannot be locked, a responsible person must remain in the vicinity to prevent unauthorised interference or movement of the vehicle.
- Particular care must be taken should it be necessary to operate on icy, muddy, waterlogged or sloping ground, as there is a much greater tendency for the vehicle to be moved by the load.
- Structural parts of the vehicle, such as axles and structural cross members should be used as anchors.
- Towing eyes should generally be avoided unless they are of closed construction and are welded or substantially bolted to the chassis.
- Vehicle bumpers, ‘bull bars’, ladder bars or grab rails should never be used as anchor points.
- Textile items such as rope or webbing slings must not be allowed to come into contact with hot parts of the vehicle such as brake drums, engine or exhaust systems.
- Sharp edges, battery acid, grease and oil must be avoided. Should contamination occur, textile items including ropes may need to be withdrawn from use and destroyed.

Knot Terminology

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Understanding the following terms will help the rope access technician to understand each instruction for how to tie the required knot.

It is useful to use soft, thin rope to practice with.

Standing Part

The main part of the rope the knot is formed from or around this.

Coil

A circular loop formed by lying the rope over itself.

Bight

A 'u' shaped loop formed in the middle of a length of rope.

Working End

The end of the rope that is handled and passes around and between coils etc.

Dressing

Knot dressing is the process of arranging a knot in such a way as to improve its performance. Crossing or uncrossing the rope in a specific way, depending on the knot, can increase the knot's strength as well as reduce its jamming potential.

Overhand Knot

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The overhand knot is the most suitable knot for creating a secure compact loop in the end of a rope.

This knot is easy to tie and doe snot slip under load, but may come loose if not tightened properly. This knot is also difficult to undo after heavy loading.

The strength of a well tied and dressed overhand knot is approximately 30% less than the original breaking load of the rope.

A rethreaded overhand knot is used to connect the cowstails to the harness.

Method

1. Loop the rope back on itself by approximately 30cm, creating a bight

2. Thread the bight through the loop

3. Dress and tighten the knot ensuring the tail is at least 10cm long

Figure of eight knot

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Figure of eight knot

The figure of eight knot is the most suitable knot for creating a secure loop in the end of a rope.

This knot is easy to tie and untie and does not slip under load.

The strength of a well tied and dressed figure of eight knot is approximately 30% less than the original breaking load of the rope.

Method

1. Loop the rope back on itself by about 50cm to create a bight

2. Take the bight back over the rope

3. Thread the bight through the loop

4. Dress and tighten the knot ensuring the tail is at least 10cm long

Alpine Butterfly

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Alpine Butterfly Knot

The Alpine butterfly knot is the most suitable knot for creating a loop off to the side of a rope as it can take a multi-directional load. Also used to isolated a damaged section of rope, often in conjunction with an overhand knot.

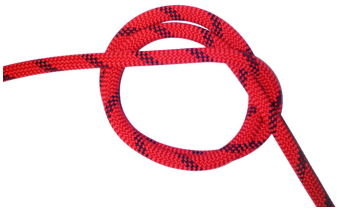
This knot is easy to tie and does not slip under load.

The strength of a well tied and dressed knot is approximately 30% less than the original breaking load of the rope.

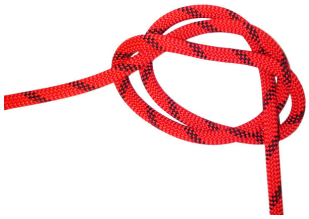
Method

1. Form three loops in the rope

2. Take a loop from one side over the top of the other loops



3. Take the next loop from the same side over the top of the other loops



4. Thread the last loop taken over back through the hole in the loops

5. Adjust the length of the loop and dress the knot

Double Figure of Eight (Bunny's Ears)

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Double Figure of Eight Knot (Bunny's Ears)

The double figure of eight knot is the most suitable knot for creating two secure loops in the end of the rope.

The knot is easy to tie and untie and does not slip under load.

The strength of a well tied and dressed knot is approximately 30% less than the original breaking load of the rope.

Method

1. Loop the rope back on itself by approximately 150cm

2. Start to tie a figure of eight as far from the end as possible

3. Take the end loop over the two loops in the figure of eight

4. Pull the two loops to form the knot

5. Dress the knot

6. Pull either of the two loops to adjust their length

7. Take the sliding loop back over the knot to the running end of the knot and tighten to secure

Barrel Knot

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Barrel Knot

A barrel knot is used to connect cowstails to karabiners as it grips the karabiner tightly and reduces the chance of cross loading.

Testing has shown that a barrel knot has greater shock absorbing qualities than other knots used on the ends of cowstails

Care must be exercised when tying a barrel knot. Ensure it has been tied correctly, so that when the cowstail is weighted, the knot must tighten around the karabiner and must not pull through.

Method

1. Pass the end of the cowstail through the karabiner

2. Take the end around the cowstail twice

3. Thread the end of the cowstail down through the two loops and tighten leaving a 10cm tail

Stopper Knot

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Stopper Knot

A stopper knot must be used on the end of every rope that is rigged. They are used to prevent a rope access technician abseiling off the end of the rope.

It is usual for a the tail of the rope to extend below the stopper knot, at least 30cm in length.

Method

1. Wrap the rope twice around itself

2. Thread the end of the rope back down through the two loops and tighten

Re-threaded Overhand Knot

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Re-threaded overhand knot

A re-threaded overhand knot is primarily used for attaching cowstails to the attachment point on the rope access technicians harness.
This knot is straightforward to tie and uses less rope than a figure of eight knot. It is also acceptable to use a re-threaded figure of eight knot for this purpose.

Method

1. Tie an overhand knot in the cowstail approximately 30cm from the end.

2. Pass the shorter end of the cowstail through the attachment point.

3. Re-thread this end of the cowstail back through the knot following the path of the overhand knot.

4. Ensure the re-threaded overhand knot is tightened up sufficiently and the tail end of the rope is at least 10cm long.

A re-threaded overhand knot and a barrel knot on a 1m cowstail.

Simple Principles of Rigging

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Simple principles of rigging

The anchor position for ropes should be carefully chosen to allow the simplest rigging possible, preferably to the strongest anchor points available.

However, it is often necessary to utilise divided anchors to position the ropes exactly as needed or other to use other rigging methods such as re-anchors (re-belays) or deviations.

Consider the effect of stretch of ropes when rigging long drops. Low stretch rope has an elongation under load of around 5%, or around 1.5m on a 50m drop.

[One reason why dynamic rope is unsuitable for use as a working rope or a back-up rope is its excessive stretch – up to around 8% under a static load (or 4m on a 50m drop) or over 30% under high dynamic loads].

Ropes should always have stopper knots rigged in them about 30cm above the ground to reduce the effect of an uncontrolled descent and the ends of the rope should be bagged and tied off at the base of the drop.

Do not leave hanging ropes in place overnight as wind action can seriously abrade a rope on edges.

CAUTION: On very long drops, the back up rope could stretch considerably if suddenly loaded with the user's weight. This effect can be reduced by slowly loading the back-up rope as the ground is approached.

Protecting rigged ropes against damage

Ropes should always be protected against the possibility of damage, which can occur because of abrasion, cutting, the actions of third parties or damage arising from the work task, e.g. grit blasting.

It may be necessary to enforce exclusion zones around anchorage positions to ensure that ropes are not tampered with or are subject to damage from other work activities which might be taking place in the area.

Tensioned ropes are particularly prone to damage, especially from cutting and abrasion. Avoid ropes passing over sharp edges – either laterally or vertically.

There are four methods of protecting ropes against damage:

- Move the path of the rope away from the point of abrasion (a deviation);
- Rig intermediate anchor points (re-anchors, or re-belays) below the rub point or to reduce excessive movement in ropes, from bouncing during ascent/descent or from sideways movement such as pendulums;
- Fix protection to the abrasion point;
- Fix protection to the rope (less preferred than protecting at the abrasion point itself because the rope protector can move until no longer next to the abrasion point).

Rope protectors

Canvas rope protectors are commonly used to protect ropes from abrasion, either at the top of a descent or at other points lower down. PVC is also available but is less durable and offers less protection. Other forms of padding may also be suitable. Metal edge protection devices are also available from a range of manufacturers.

Rope protectors should be attached to the rope above the point of use with a prusik knot on small accessory cord, and suspended so that protection is available where needed. It is important that the prusik knot is tight to ensure the protector does not slide down the rope.

Do not assume that a rope protector will always protect against a sharp edge.

Divergence Angles in Multiple Anchor Systems

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Divergence angles in multiple anchor systems

In anchor systems utilising more than one anchor, the angle that is formed between the anchors and the load will affect the force exerted on each anchor.

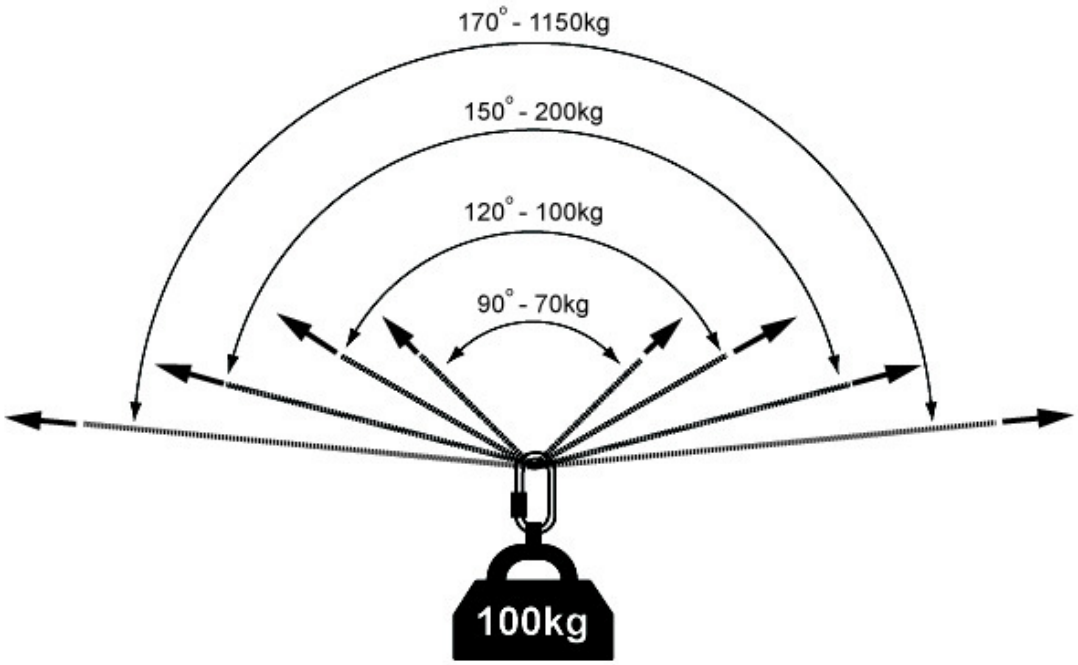
An angle is formed between the two legs extending from the anchors at the point where the rope is directed towards the load.

At first glance, it might appear that when a 100kg load is attached to the main system it would be shared evenly between the two anchors, i.e. with each anchor having a loading of 50kg. This is only the case where the angle between the two legs is zero degrees. The actual force on each anchor depends on the angle between the two slings or legs. The wider the angle, the greater the force exerted on each anchor and its associated rigging.

If the angle between the legs is widened to 90-degrees, the forces on each anchor increase significantly to around 70kg.

If the angle is then further widened to 120-degrees the full weight of the load is exerted onto each of the anchors and its associated rigging. Widening of the angle further still would create stresses on each anchor greater than the load itself.

When dividing loads between anchors angles must, therefore, be kept as low as possible and in any case must not exceed 90 degrees. Reducing the angles, and thus reducing the load on each anchor, may be achieved by extending the length of the legs from the anchors. Where this is not possible, more anchors should be added to help share the load.



Elementary Rigging Methods

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Fig.1

1. Single Figure of 9 method

The anchors are unquestionably reliable and there is no requirement to re-position the line of the ropes.

Attach the ropes separately and independently to the anchors using single figure of 9 knots.

When it is suspected that either of the anchors is less than “unquestionably reliable” (e.g. less than 15kN), or if you need to use separated anchors to position the line of the ropes, join the two anchors together with a Y-shaped system. Ensure that both legs have equal tension. The internal angle between the ‘Y’ should not exceed 90 degrees.

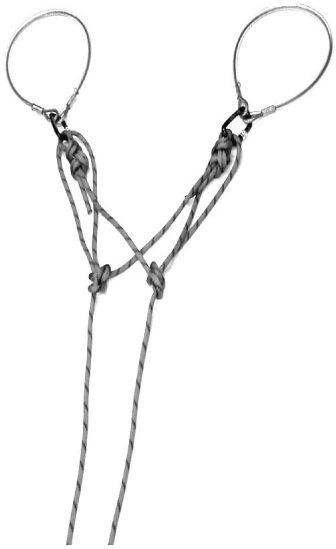
Fig.2

2. Figure of 8 on the bight (Bunny's Ears) method

Used when the anchors are close together and situated the same distance from the point of descent.

Both knots are tied into both anchors then adjusted to give the correct positioning and tension in the legs.

Fig.3



3. Figure of 9 and Alpine Butterfly method

Used when the anchors are far apart or one is further from the point of descent than the other.

- The figure of 9 is attached to each anchor.
- The Alpine Butterfly is tied in each rope and attached to the opposite anchor.

The system is adjusted to position the ropes in the descent line.

Notes:

- Check the route for sharp edges; protect these with pads, rope protectors or deviations.
- Ensure the ropes will not swing into dangerous areas during use, causing entanglement.
- Cordon off around rigging to ensure nobody interferes with the system, use a sentry if required.

Attachment Configurations for Slings & Strops

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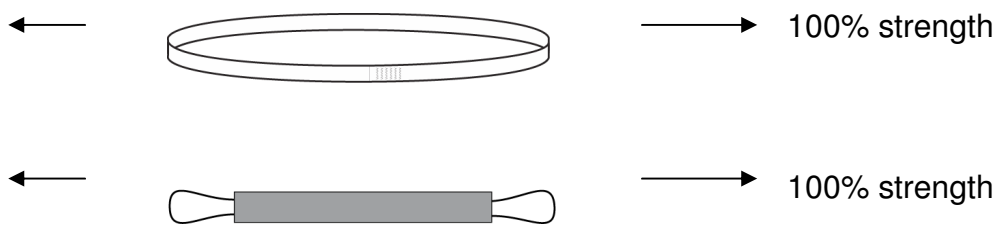
Attachment configurations for slings and strops

Care must be taken when attaching strops and slings around objects. The pattern used for attachment affects the strength of the resultant anchorage system and may unknowingly create a low loading figure.

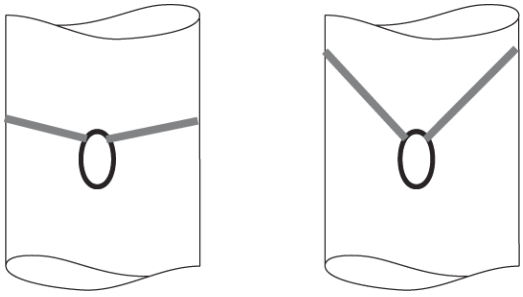
Inline

Used when extending anchorages. Full strength is maintained.



Around objects

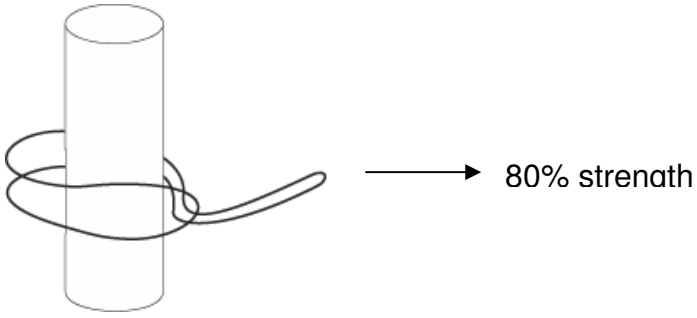
Tension created by using a sling that is too short may cause the connector to load badly across the gate and will greatly decrease the strength of the sling, possibly below 100% strength.



Short sling, too taut Correct length

Choking

This creates a weak point where the slings meet, reducing the strength of the resultant anchor and creating a friction point during loading



Rope Edge Protection

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Rope Edge protection

Ropes are particularly vulnerable to damage caused by abrasion, cutting, melting or chemical contamination. Damage can be exacerbated by vertical or horizontal movement of the anchor lines, especially when they are under load, e.g. when ascending, descending, making sideways movements or in a fall.

Employers should identify any hazards and examine how they can be removed or, if this is not possible, determine how the risk can be reduced to an acceptable level. Hazard identification should comprise identification of anything with the potential to cause harm. This includes, for example, sharp or rough edges on which the anchor lines could be cut or abraded.

Control measures

When considering the protection of ropes (sometimes referred to as 'anchor lines') against sharp or rough edges a hierarchical approach should be adopted:

Avoid
Ropes should be rigged so that, wherever possible, they hang free naturally and do not come into contact with hazardous surfaces, e.g. edges or abrasive or hot surfaces.

Prevent
Where this cannot be done, e.g. where it is not possible to arrange a natural free hang, then ropes should be protected by using *deviations* or *re-anchors*. These should be robust enough not to fail at any potential load to which they could be subjected.

Mitigate
Where this cannot be done, it is essential that ropes are suitably protected against the hazard, e.g. by the use of:
(a) *edge protec*tors such as rollers, metal edge plates, suitably fitted scaffold tubing, edge padding, or
(b) *rope protectors* such as a textile sheath which encapsulates the anchor line.

In some case a combination of both types of protection can be used. There is evidence to show that it is prudent to use **separate** rope protectors for the working rope and the safety rope.

Selection criteria

There are no known standards for edge protectors and rope protectors. Criteria for their selection include:
a) suitability for the particular site conditions, e.g. provides adequate protection against cutting, abrasion, excessive heat or chemical contamination;
b) suitability for compatibility with rope type, e.g. construction and diameter, and number of ropes;
c) feature(s) to allow them to be tied off (if required) to keep the edge protectors and rope protectors in their intended place and to maintain the rope(s) in position within or on them;
d) a design that allows the rope access worker to place and to pass the edge protector or rope protector;
e) the ability to inspect the rope(s) while located in or on the edge protector or rope protector.

Rigging and de-rigging

Rope access workers should normally descend vertically with the minimum amount of swing (or 'pendulum'), in order to minimise the risk of abrasion to the rope(s) or putting unnecessary stress on them or the anchors. On long descents, anchors providing lateral restraint (e.g. deviation anchors) could be fitted on the anchor lines to enable the rope access worker to maintain their position without being buffeted too much by the wind.

Edge Protection Hierarchy

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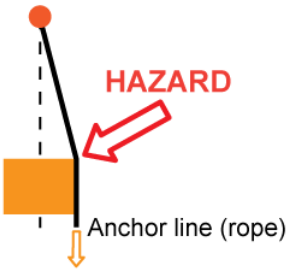
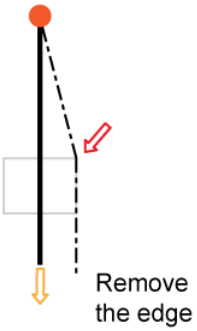
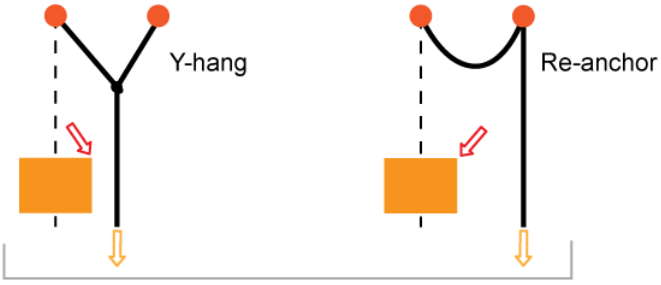
Please note:
This document assumes that rope access is the appropriate access method
Only one rope is shown, for clarity

Hazard: Something with the potential to cause harm
Edge: Sharp, rough, serrated, hot, abrasive, etc.

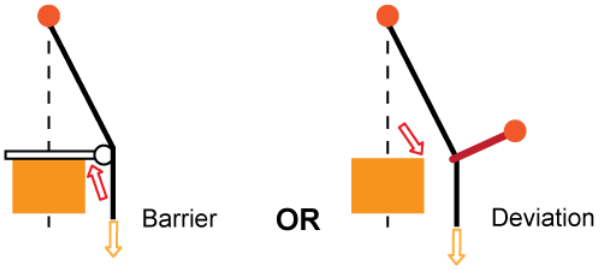


AVOID

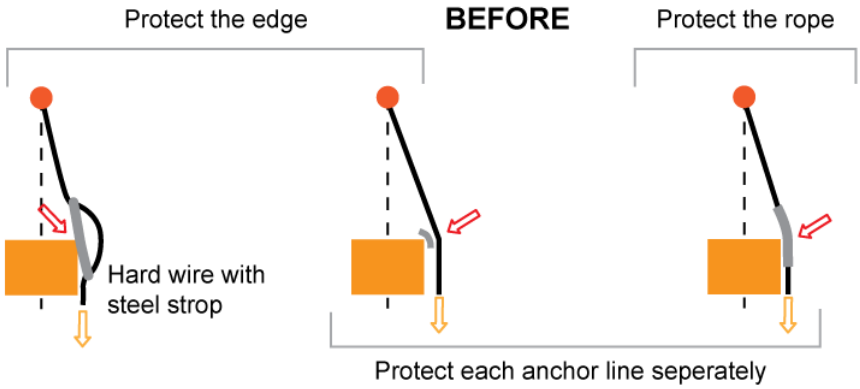


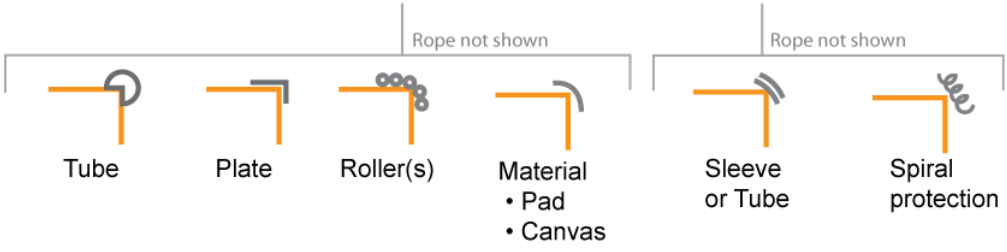


PREVENT



MITIGATE





Selection of Edge and Rope Protectors

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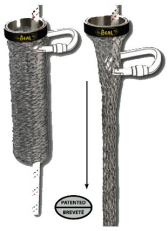
Selection of Edge and Rope Protection

heightec Rope Protector 1m



Beal Rope Armour

SMC Rope Tracker

heightec Magic Carpet

Canvas Rope Protector

Tractel Rope Protector

heightec Canvas Rope Protector

ISC Wire Anchor Strop

Ruth Lee Rope Edge Protector

heightec MR75 edge protector

Petzl Caterpillar

Ferno Ultra-Pro Edge Protector

RA/SMC Edge Rollers

Petzl Edge Roller

RA/SMC Roof Roller

Passing Mid Rope Protection

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NOTE: Use of canvas rope protectors for protection against minor abrasion – one for each rope is the preferred option.

In Ascent

- Ascend the ropes to the bottom of the rope protection
- Open the rope protection, whilst fending yourself off the structure
- Remove the rope protection and replace securely on each rope underneath your devices
- Secure the rope protection around each rope, ensuring the rope protection protect the ropes from abrasion for the next climber

In Descent

- Descend to the rope protection
- Lock off your descender
- Open the rope protection, whilst fending yourself off the structure
- Remove the rope protection and replace securely on the ropes above your devices
- Continue on your descent and secure the rope protection around each rope, ensuring the rope protection protects the rope from abrasion for the next climber

Edge Obstructions at the top

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Edge obstruction at the top

NOTE: Ropes rigged at 90º to drop

The edges of roofs, platforms, cliffs, cavities and other drops may be unprotected or surrounded by edge protection such as guardrails or parapet walls. In many cases, the edge presents both an awkward obstruction for the rope access technician and a contact hazard to the ropes.

Always ensure ropes are attached from an area of safety where there is no risk of a fall occurring. If this is not possible, then work restraint or fall arrest techniques may be used in order to access the work area safely. Care must be taken when ascending over an edge to prevent falls onto ascenders. Consideration may be given to attaching a long cows tail or changing onto a descender.

CAUTION:

- Rope stretch when anchors are set back from the edge
- Use of footloop when descending difficult or undercut edge
- Avoidance of trapping the descender – making it difficult to unlock

Use of a Workseat

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Use of a workseat

A risk assessment may indicate that prolonged suspension will requires the use of a support seat. This offers leg support while performing all rope access manoeuvres.

If a work seat is used, it must be an addition to the normal rope access system, not a substitute for any part of it.

The work seat can be connected directly to the central attachment point of the harness. The seat is connected through the attachment point to the harness in such a way that the weight of the rope access technician is taken by the seat only just before coming tight onto the connection to the descender.

Note – in some situations when using a work seat, the operator may need to slightly extend the connection to the descender to improve flexibility. In this case, connect the seat karabiners directly into the descender karabiner.

Rescue Procedures - General Considerations

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Rescue Procedures - General considerations

Additional care should be taken during any rescue procedure - not least because the safety of another person is concerned.

The following points should be noted at all times:

- Do not allow the urgency of the situation to compromise safety.
- Act quickly and efficiently (with due regard to the above).
- Two independent attachment points must always be maintained. This is true for the casualty as well as the rescuer. The casualty is generally attached to a system for movement with an additional back-up.
- The casualty must be cared for at all stages of the rescue. If they are unconscious, try to rouse them (a lack of limb movement on behalf of the casualty will cause grave circulatory problems). An unconscious casualty should be brought upright as quickly as possible using their chest harness.
- Approach each part of the process carefully and deliberately. Watch out for actions which could lead to problems (for example, becoming 'hung-up' on a back-up device when loaded with a casualty).
- Plan all stages of the rescue before beginning.

Suspension intolerance (syncope)

Remember that the casualty may be suffering from adverse effects of hanging in their harness, especially if they are not moving. (See 'Foundations' notes on suspension intolerance).

It is essential to maintain circulation to the casualty's lower body. Remember to agitate the casualty's limbs and if appropriate to elevate their legs to reduce pooling of blood to the legs.

Treatment of a casualty who has been recovered to the ground

Call for medical help immediately.

If a casualty has suffered the effects of suspension intolerance no change should be made to the standard first aid guidance for the post recovery of a semi-conscious person in a horizontal position, even if the subject of prior harness suspension.

Further information is available at: http://www.hse.gov.uk/falls/harness.htm

Basic Rescue Technique

heightec®

The National Access and Rescue Centre

www.heightec.com

The minimum rescue capability for any rope access technician is to be able to recover a casualty who is in descending mode on a vertical drop without any intermediate obstructions between the casualty and the ground.

The rescuer may be able to use an additional set of ropes or may have to descend the casualty's back-up rope, using the casualty's suspension rope for back-up.

The rescue can be thought of as having five stages:

- Call for help
- Access the casualty
- Make them safe
- Remove their equipment
- Descend to safety

Rescue of a Person in Descent Mode - 2 Sets of Ropes

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The National Access and Rescue Centre

www.heightec.com

Procedure for rescue of person in descent mode using a full body harness, two sets of ropes and a two person back-up device

The rescuer should carry out the rescue as follows:

1. Descend level with the casualty, add extra friction karabiner to descender and lock off.
2. Check the condition of the casualty and pull them upright.
3. Make sure all ropes are clear from between casualty and rescuer.
4. Attach a long cowstail between casualty and rescuer to lower D-ring on harness.
5. Connect casualty's sternal D ring to rescuer's descender karabiner using two spare karabiners.
6. Lower casualty onto rescuer using casualty's descender.
7. Slacken casualty's descender and remove.
8. Descend slowly and carefully - ensure extra friction karabiner control is employed to counteract extra weight.

NOTE:
Remember to take note of the warnings about handling of the casualty when they have reached the ground in the previous section (suspension syncope).

Basic Hauling

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A basic hauling system can be utilised to raise up a casualty to a platform, manoeuvred over an edge and then lowered to the ground.

It is best practice for the rescuer to work from a position of safety i.e. from behind a fixed barrier or handrail or using a work restraint or horizontal line system.

Any of the previous hauling systems can be utilised for this rescue along with a suitable back up system.

If the casualty needs to be manoeuvred over an edge the rescuer may use a high deviation or introduce a tagline into the system to increase manoeuvrability.

When attaching the casualty to the rescue system the rescuer must try to keep the casualty as upright as possible throughout the haul and lower.

Hauling techniques may be also combined to create more complex systems for hauling people or equipment, such as:

- Cross haul
- Hanging haul
- Tensioned lines

Z-Rig Hauling and Tensioning

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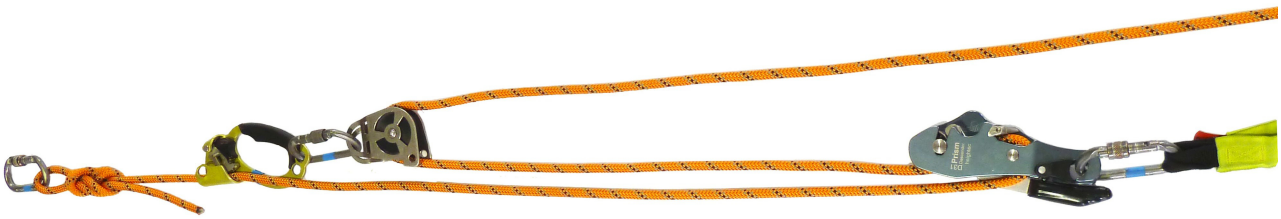

The Z-rig hauling system is a compact assembly used for tensioning ropes or hauling/raising a casualty.

This system relies on the locking device allowing the rope to flow one way when hauling, then locking when released. The load can be released easily and in a controlled manner by operating the locking device handle.

The system only requires a small amount of rope to set up. It will then ratchet more in during the hauling operation.

The mechanical advantage gained in this system is about 2:1. In theory it looks like it should be 3:1 but that would only be the case if there was a pulley in place of the locking device.

Care must be taken when hauling heavy loads as the rope grab may damage the sheath of the load rope with a hauling force of 200 kg.

Typical Arrangement of a Lowering Line

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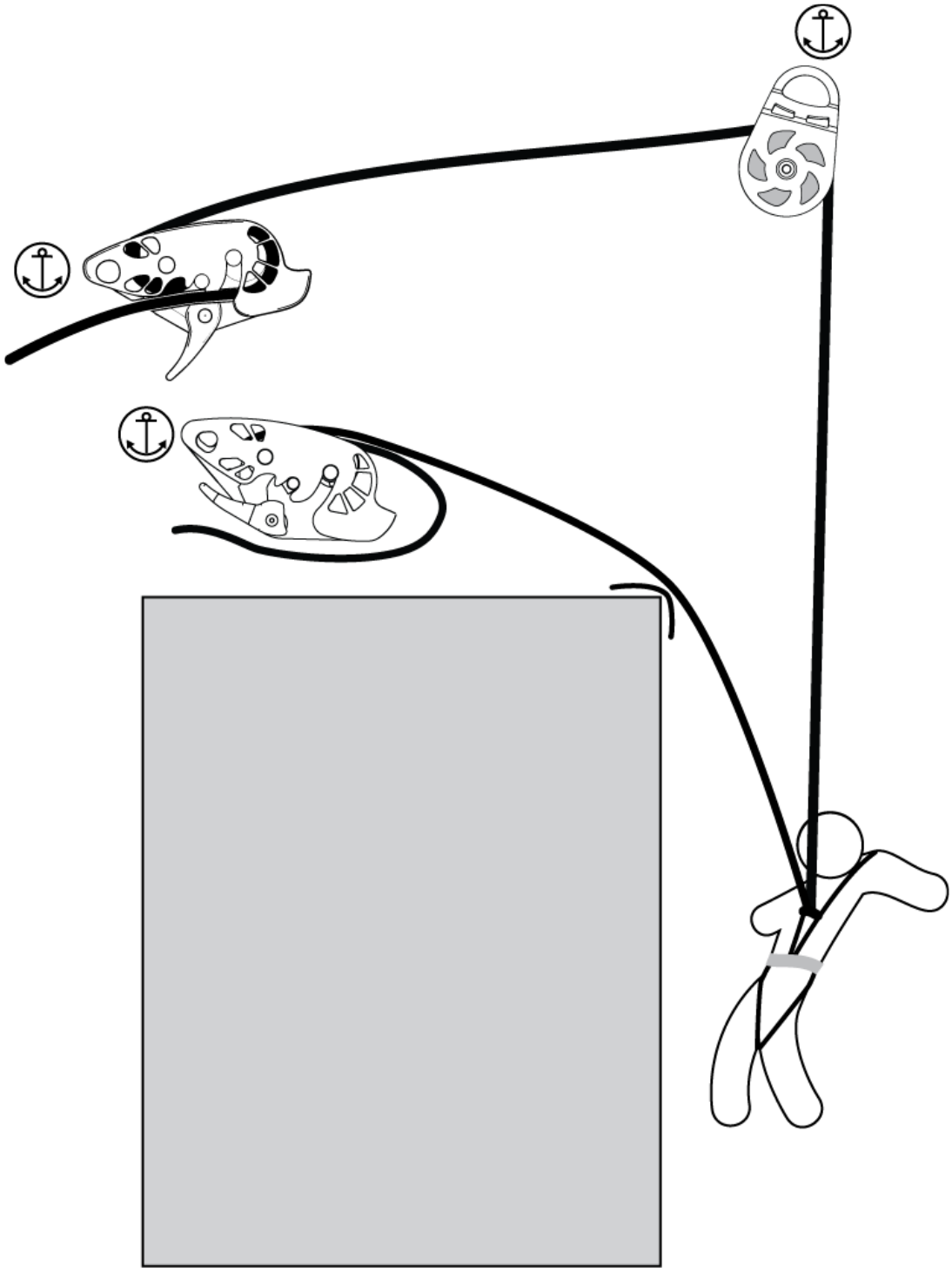
Typical arrangement of a lowering line with additional safety line



Example of rigging for rescue in rope access

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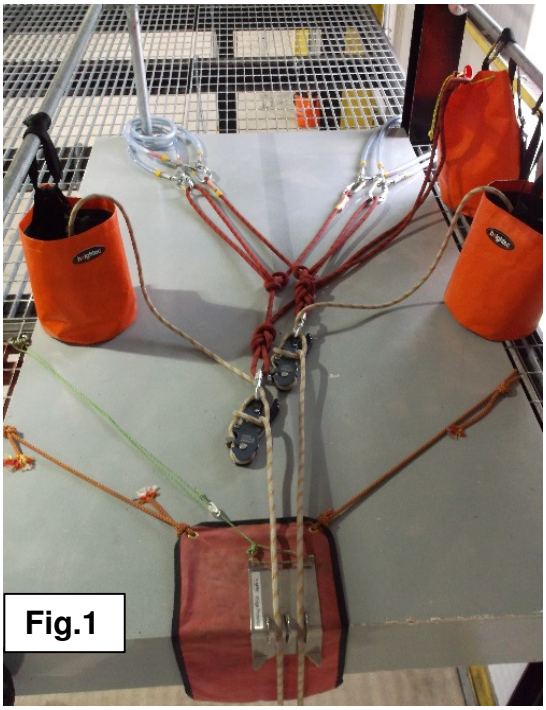

Fig.1

Rig the descent rope and back up through a descender attached to the main anchor points.

Use bagged ropes to keep the site tidy and ensure there is enough rope to reach the ground as in **Fig.1**

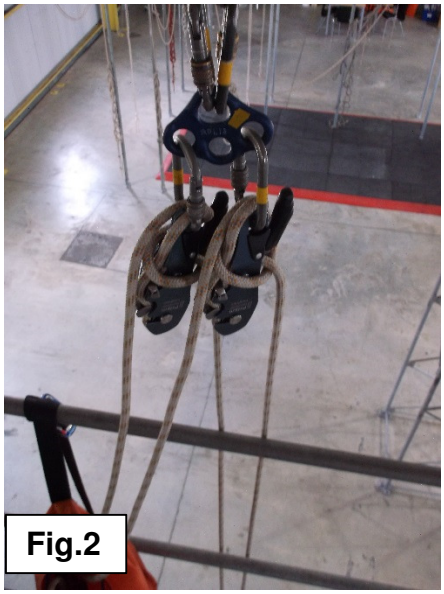

Fig.2

2. Ropes can be rigged from above the worksite but ensure they can be reached easily if required. **Fig.2**

Example of Rigging for Rescue in rope access

3. Ropes can be rigged from ground level through re-direction karabiners to allow somebody to release the system from a safe area **Fig.3**

Fig.3

Fig.4

4 Use bagged ropes to keep the worksite tidy and ensure there is enough rope in the bags to lower the casualty to the ground. **Fig.5**

Equipment for Rope Access

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Quantum rope back-up device

Description

This device is used to move up and down the safety line and is designed to lock onto the rope in the event of a fall.

Criteria For Selection

A back up fall protection system for rope access or general vertical or sloping fall arrest situations.
May be used as part of a restraint system
2 person loading for use in rescue situations

Conformity/loading Characteristics

EN 12841 type A, EN 353 - 2, EN 358
Maximum load 200kg
Alloy body with stainless steel cam
Rope diameter between 10.5mm and 11.5mm

Compatibility with Other Products

Can be used on a dynamic rope cowstail up to 0.45m. This lanyard can be up to 0.90m if less than Fall Factor 1

Pre-use Check

1. Cam moves freely
2. The front plate and catch open and close correctly
3. Rope is correctly inserted between the two cams
4. Both side plates are connected together
5. Device runs freely up the anchor line and locks when pulled downwards

Installation, Fitting or Wearing

1. Open the catch - to save dropping, the device back plate may remain clipped
2. Rotate open the front plate
3. Feed the anchor line between the cam and the friction bollard
4. Close the front plate and ensure the catch closes
5. To remove the device, reverse this process

Methods of Use (Practical Requirements)

The device an be taken down the rope in a fall if the body is held in use.
May be used in extreme emergencies to provide a back-up when lowering a casualty, although great care is needed to ensure the device is not held open at a moment when it needs to be applied.
Ascent - allow the device to be towed up the rope by the lanyard attachment
Descent - the device will descend down the rope under its own weight
* Where possible avoid manual manipulation when used as a fall arrest back-up device
* For work restraint on flat roofs, a stopper knot is required at the roof edge
* All anchor lines must have a stopper knot or other termination at the free/bottom end
* A small mass (1.5kg) anchored to the base of the rope helps smooth movement in ascent and descent

Specific Inspection, Care or Maintenance Requirements (if any)

Wear, particularly where the rope normally lies. Deformation, cuts, cracks, heavy marking, scoring, burring, corrosion. Contamination by chemicals e.g. pitting, flaking of aluminium products (usually due to salt water). Build up of foreign matter e.g. grit, grease, paint. Moving parts function correctly e.g. handle pivots correctly, spring and hinge pin is in good condition. If in doubt on any point, remove from service. Wash in clean water, dry before storage. Oil lightly at the pivot.

Identifying Defects

Scrap any product which is at all suspect, or has been subjected to a shock load.

Other Information

Other devices with similar mode of operation e.g. RED, Goblin, Buddy, Rocker.

Prism descender

Description
This device is used to control the descent of a person down a rope, either abseiling or lowering.

Criteria For Selection
The Prism does have a double action safety feature, e.g. the device will brake if the operator panics and operates the handle improperly.
Aluminium construction, plastic covered handle and stainless steel cam.

Conformity/loading Characteristics
EN 341 Class B, EN 12841 Type C
Maximum load 200 kg dynamic, 200 kg emergency lowering.

Compatibility with Other Products
Suitable for use with 10.5 -11.5 mm diameter rope conforming to EN 1891 A.

Pre-use Check
Make sure cam is not worn out.
Check moving side plates for deformation or excessive play.
Check locking components and springs.

Installation, Fitting or Wearing
Ensure correct orientation of device on harness connection.

Methods of Use (Practical Requirements)
Open the front plate by opening the latch. Insert the rope in the device according to the diagram on the body. The device is then attached to the harness waist attachment point for abseiling. For lowering, choose a secure anchor (15 kN minimum) in a position that will not affect the operation, i.e. trapping the handle against a wall. Rope is given out of the device by gently operating the handle. The tail rope must always be held for control during use. Carefully control the handle and the grip on the tail rope to ensure a slow descent.

BE AWARE: Always lock off the device when not being used for descent or lowering. The handle may be prone to accidental operation if not locked off. Never let go of the tail rope when descending or lowering a person.
An additional karabiner is NOT required to add friction when lowering a person or load or when descending with a casualty.

Specific Inspection, Care or Maintenance Requirements (if any)
Wear, particularly where the rope normally lies.
Deformation, cuts, cracks, heavy marking, scoring, burring, corrosion.
Contamination by chemicals, e.g. pitting, flaking of aluminium products (usually due to salt water).
Build up of foreign matter, e.g. grit, grease, paint.
Moving parts function correctly, e.g. handle pivots correctly, spring and hinge pin is in good condition.
Scrap any product which is at all suspect, or has been subjected to a shock load.
If in doubt on any point, remove from service.
Wash in clean water, dry before storage.

Identifying Defects
Note: Defects cannot be repaired by the user.
Retired or damaged equipment must be destroyed before disposal.

Other Information

I'D descender

Description

This device is used to control the descent of a person down a rope, either abseiling or lowering.

Criteria For Selection

Designed for work on EN 1891 low stretch rope rope.
The I'D has a double action safety feature, e.g. the device will brake if the operator panics and operates the handle improperly

Conformity/loading Characteristics

EN 341 Class A.
Maximum load 150 kg dynamic, 250 kg emergency lowering.
Aluminium construction, plastic handle and stainless steel cam.

Compatibility with Other Products

Certain ropes may be slippery: new ropes, small diameter ropes, wet or fraying ropes, etc.

Pre-use Check

Make sure cam is not worn out.
Check moving side plates for deformation or excessive play.
Check locking components and springs.

Installation, Fitting or Wearing

Always lock off the device when not being used for descent or lowering.
The handle may be prone to accidental operation if not locked off.
Never let go of the tail rope when descending or lowering a person.
An additional karabiner is required to add friction when lowering a person or load or when descending with a casualty.

Methods of Use (Practical Requirements)

Open the front plate by opening the latch, insert the rope in the device according to the diagram on the body. The device is then closed. Attach to the harness waist attachment point for abseiling.
For lowering choose a secure anchor (15 kN minimum) in a position that will not affect the operation, i.e. trapping the handle against a wall. Rope is given out of the device by gently operating the handle. The tail rope must always be passed through a friction karabiner and held for control during use.
Carefully control the handle and the grip on the tail rope to ensure a slow descent.

Specific Inspection, Care or Maintenance Requirements (if any)

Wear, particularly where the rope normally lies.
Deformation, cuts, cracks, heavy marking, scoring, burring, corrosion.
Contamination by chemicals, e.g. pitting, flaking of aluminium products (usually due to salt water),
Build up of foreign matter, e.g. grit, grease, paint.
Moving parts function correctly, e.g. handle pivots correctly, spring and hinge pin is in good condition.
If in doubt on any point, remove from service. Wash in clean water, dry before storage.

Identifying Defects

Scrap any product which is at all suspect, or has been subjected to a shock load.

Other Information

ASAP

Description
Mobile fall arrest device for use on rope

Criteria For Selection
Single rope back up device for fall arrest whilst climbing structures / ladders or using rope access.

Conformity/loading Characteristics
EN12841 : 2006 A
EN353-2 : 2002
2 person loading (depending on energy absorber used)

Compatibility with Other Products
Use only with specified rope - EN1891 A
Diameter 10.5mm - 13mm
Do not use with hawser laid ropes
Only connect to the ASAP with the Petzl OK Triact karabiners

Pre-use Check
Ensure device is attached to rope in correct orientation - a sharp pull downward will check this.
Check the attachment karabiner fits through both holes in the body and around the rope.
Ensure the clearance below the device is 3.9 metres minimum.
Check the connectors are aligned in the major axis.
Ensure there is a stopper knot in the end of the rope.

Installation, Fitting or Wearing
Connect the device to the front sternal attachment point of a full body fall arrest harness either directly or with a specific energy absorbing unit. Ensure correct orientation in harness connection for vertical operation.
Take the karabiner out of the ASAP, swing the wheel down by pressing down on the arm with your thumb. Put the rope into the body and let the wheel release. Fit the karabiner through both eyes of the body ensuring the rope is captive in the karabiner.

Methods of Use (Practical Requirements)
The device will move freely up and down the rope without manual assistance but should be kept as high as possible above the user during use. If device is shock loaded in descent it will lock onto the rope, to release unweight the device then push it up the rope against the wheel until it clicks the denote reset has occurred.
Do not use as a work positiong device.

Specific Inspection, Care or Maintenance Requirements (if any)
Check for damage or deformation of body and wheel.
Ensure all springs operate correctly
Check that teeth are in good condition, clean and none missing from wheel.
Check the connectors and energy asbsorbing elements are in good condition.
Take care during cleaning to not damage the seals on the wheel, only use water at atmospheric pressure, no solvents.

Identifying Defects
Rotate the locking wheel one full turn in each direction to check operation is smooth.
Pull device down sharply to check locking mechanism is working correctly.

Other Information
Do not extend the connection element with slings or extra karabiners. Ensure no slack develops in the rope above the device during use, especially in windy conditions (consider a small weight on the rope).

Pulsar Hand Ascender

Description
To provide quick and easy connection to a rope, for casualty attachment, ascent of a rope or as part of a mechanical system.

Criteria For Selection
Strong and intuitive to use with few moving parts.
Safety catch will prevent accidental release of rope.
Cam is slightly toothed to assist purchase but should not produce damage to rope.
Some brands have significant sharp teeth.
Can be attached to a rope which is already taut or slid down a vertically loaded rope during hauling.

Conformity/loading Characteristics
EN 567.
Maximum load around 600 kg before rope damage.
Some brands will damage the rope at around 450 kg.

Compatibility with Other Products
For use with 10.5 mm or 11 mm kernmantel rope.

Pre-use Check
No deformation of body.
Correct functioning of cam and safety catch.
No broken springs.

Installation, Fitting or Wearing
Open the cam by releasing the safety catch and install onto rope with the attachment holes in the body of the device facing away from the load to be lifted (or facing down if climbing a rope). Cam will allow movement towards the load but will lock when pulled away from the load.

Methods of Use (Practical Requirements)
Do not allow body to become bent over an edge.
Not intended for dynamic loading. Dynamic loads will greatly increase the risk of rope damage.

Specific Inspection, Care or Maintenance Requirements (if any)
Check:
- Cam surface, hinge, rivets, spring function, deformation, cracks, marking or scoring.
- Correct function of moving parts.

Identifying Defects
Note: Defects cannot be repaired by user.
Retired or damaged equipment must be destroyed before disposal.

Other Information
Do not use for fall arrest purposes. Make sure no slack is present in hauling systems.

Karabiners

Description

To provide quick and easy connection between elements of a fall protection system.

Criteria For Selection

Steel karabiners are preferred for industrial use. Alloy karabiners are sometimes used in specialist activities such as rope access, but these are not suitable for use in corrosive environments, e.g. offshore.
Gate locking systems include threaded screw-action barrel and spring-loaded twist lock barrel.
Shapes are either oval or offset D.

Conformity/loading Characteristics

EN 362.
Minimum static strength (major axis and gate unlocked), 15 kN.
Minimum status strength (minor axis and gate closed), varies but can be a s little as 7 kN.

Compatibility with Other Products

Oval karabiners are suited for use in pulley systems and for general purpose rigging and personal suspension.

Offset D karabiners are used in fall arrest systems because the shape tends to place the load close to the strongest part of the item - known as the spine.

Pre-use Check

Proper functioning of gate and locking element.
No sharp edges, burrs, corrosion or deformation.

Installation, Fitting or Wearing

Ensure gate is always fully closed.
Do not use karabiners to connect lanyard to harness - use a screwlink for this purpose.

Methods of Use (Practical Requirements)

Do not allow body to become bent over an edge.
Avoid dropping onto a hard surface.
Do not load across the gate because of danger of failure, e.g. "roll out".

Specific Inspection, Care or Maintenance Requirements (if any)

As pre-use check. Inspect rivet, hinge and catch pin.
Also check for deformation, pitting, heavy marking or scoring.
Maintain with light oil. Store dry.

Identifying Defects

Do not use equipment if damage is suspected.

Other Information

Marking of components can be difficult - refer to the manufacturer and/or supplier for advice.
A screwlink (sometimes known as a maillon-rapide) gives better multi-directional loading capability.

Full Body Harness

Description
A full body harness for technical rope access, stage rigging and rescue.

Criteria For Selection
Multi-use harness with a high degree of lumbar support.
Front and rear fall arrest attachment and central attachment for work positioning.
Made from nylon with substantial comfort pads.
Buckles are stainless steel. Other metalwork is steel or aluminium.
Adjustable one size fits all.

Conformity/loading Characteristics
EN 358, EN 361, EN 813.
Some manufacturers may test in excess of the required 100 kg mass.

Compatibility with Other Products
Can be used as part of both fall arrest, work positioning and suspension systems.

Pre-use Check
Condition of webbing - wear, possible physical or chemical damage, condition of stitching, cuts, abrasion, discolouration.
Check metal fittings for corrosion, sharp edges, integrity, proper function.
Check threads of screwlink and twisted straps.
Ensure correct adjustment, close fitting to the body.

Installation, Fitting or Wearing
Pick up the harness by the waistbelt and remove twists.
Climb into the legloops first, and then pull up around waist.
Adjust the two waistbelt buckles first, until the harness supports itself.
Connect the front screwlink fastener through the front strap behind the central waist ring and screw fully shut by hand.
Adjust the shoulder straps by pulling up on the slack webbing to position the front attachment at the sternal position.
Adjust the legloop straps to be a close comfortable fit.
The rear leg straps can be adjusted to suit the individual by feeding the webbing through the buckles. Ensure there is enough slack in the webbing to allow a comfortable sitting position.

Methods of Use (Practical Requirements)
Use the front lower circular ring for work positioning (rope access).
The front and rear upper D-rings are for fall arrest use.
Do not connect into anything other than the main D-ring attachment points.
The side D-rings are for work positioning use - never fall arrest.

Specific Inspection, Care or Maintenance Requirements (if any)
Read the manufacturer's user instructions for advice on longevity and inspection criteria.
No webbing or stitching damage - cuts, abrasion, heat, chemicals, rust.
Buckles operate correctly. Screwlink present and operational.
Webbing taken back to donning position.
Within age limit, 10 years from first use.
Scrap any product which is at all suspect, or has been subjected to a shock load.

Identifying Defects
Note: Defects cannot be repaired by the user. Retired or damaged equipment must be destroyed before disposal.

Other Information
It is vital to make sure the front screwlink connector is fully screwed shut. Ensure the webbing straps are adjusted correctly and not twisted.

Technical Helmet for Work at Height

Description
A modern mountaineering style helmet for rope access tower climbing and rescue situations.

Criteria For Selection
Easily adjustable to fit most workers.
Lightweight and comfortable with good ventilation.
No front peak to obscure upward vision.
2-point chinstrap for maximum security.

Conformity/loading Characteristics
Conforms to EN 12492 or EN 397.

Compatibility with Other Products
Some helmets allow the fitting of ear defenders and visor.
Head torch attachment lugs are fitted.

Pre-use Check
Chin strap buckle is closed and adjusted correctly.
Headband is adjusted to be comfortable.

Installation, Fitting or Wearing
Read the manufacturer's user instructions for advice on fitting and use.
Adjust the headband to be comfortable and secure.
Adjust the chinstrap for both length and position before closing securely.
Do not wear back to front.

Methods of Use (Practical Requirements)
Use when climbing structures, working in rope access or rescue.

Specific Inspection, Care or Maintenance Requirements (if any)
Read the manufacturer's user instructions for advice on longevity and inspection criteria.
Check:

- the shell is not cracked or damaged.
- the internal cradle and the chin strap are secure.
- the adjustment system is working correctly.
- the buckle is not damaged and connects securely.
- no chemical contamination has occurred.

The helmet can be washed in mild detergent, rinsed then dried in a warm area.
Store in a clean dry area away from damaging substances.

Identifying Defects
Note: Defects cannot be repaired by the user.
Retired or damaged equipment must be destroyed before disposal.

Other Information
Do not paint or attach stickers to the shell of your helmet.
Industrial safety helmets which conform to the “normal” industrial standard EN 397 which do not have increased side impact protection and a four-point chin strap are not suitable for work at height. These helmets do not offer sufficient protection at the side of the head and have weaker chin straps which could unfasten during a fall.

Dynamic Rope Lanyard (Cowstail) - Knotted

Description
Used to connect harness to secure anchor point in a rope access system.

Criteria For Selection
Use where the operator needs to be connected to the structure at all times, whilst still being able to move freely (traversing, aid climbing).
The short length (80 cm) reduces the fall potential.
Energy absorbing property of the dynamic rope ensures force experienced by the user in the event of a fall is below 700 kg (if knotted not sewn terminations).

Conformity/loading Characteristics
EN 892.

Compatibility with Other Products
Primary method of energy absorption in fall arrest.
Not to be used for suspension.
Connect to the harness with screwlink or tie directly into the front attachment point.

Pre-use Check
- Ensure knots are tied tightly and correctly with at least 10cm of tail.
- Ensure general good condition with no signs of excessive degradation - cuts, abrasion, heat, chemicals, rust.

Installation, Fitting or Wearing
Attach to front sternal or waist attachment of harness.
Always attach to harness with a screwlink, or tie directly into the harness using a secure knot (figure of 8, overhand, barrel)

Methods of Use (Practical Requirements)
The connector should be free to pull in the direction of load without any bending.
Do not pass over sharp edges.
Attach connector to anchor directly, do not attach around large anchor by clipping connector back onto lanyard.
Never climb above point of attachment.
Do not use for personal suspension.
Ensure clearance is sufficient in the event of a fall to avoid possible collision with structure.

Specific Inspection, Care or Maintenance Requirements (if any)
See above for pre-use check. Wash in clean warm water and dry away from heat.

Identifying Defects

Other Information
When using as twin lanyards, be aware that if the lanyards are both connected at the same height the impact force will be doubled in the event of a fall.

A fall is always dangerous. Collision with the structure is a real hazard, particularly in the event of a pendulum swing or fall against a lattice structure. The lanyard is only as strong as the anchor point it is attached to. An inadequate anchor point will provide no protection at all.

Dynamic Rope Lanyard (Cowstail) - Sewn

Description
Used to connect harness to secure anchor point or back up system in a rope access system.

Criteria For Selection
Use where the operator needs to be connected to the structure at all times, whilst still being able to move freely (traversing, aid climbing).
The short length (60 cm) reduces the fall potential.
Energy absorbing property of the dynamic rope ensures force experienced by the user in the event of a fall is reduced.

Conformity/loading Characteristics
EN 354 2002.
EN 795 Class B.

Compatibility with Other Products
Primary method of attachment to rope access back up devices.
Connect to the harness with screwlink into front attachment point.

Pre-use Check
Ensure general good condition with no signs of excessive degradation - cuts, abrasion, heat, chemicals, rust.

Installation, Fitting or Wearing
Attach to front sternal or waist attachment of harness.
Always attach to harness with a screwlink.

Methods of Use (Practical Requirements)
The connector should be free to pull in the direction of load without any bending.
Do not pass over sharp edges.
Attach connector to anchor directly, do not attach around large anchor by clipping connector back onto cowstail.
Never climb above point of attachment.
Do not use for personal suspension.
Ensure clearance is sufficient in the event of a fall to avoid possible collision with structure.

Specific Inspection, Care or Maintenance Requirements (if any)
See above for pre-use check. Wash in clean warm water and dry away from heat.

Identifying Defects
Note: Defects cannot be repaired by the user.
Retired or damaged equipment must be destroyed before disposal.

Other Information
When using as twin lanyards, be aware that if the lanyards are both connected at the same height the impact force will be doubled in the event of a fall.

A fall is always dangerous. Collision with the structure is a real hazard, particularly in the event of a pendulum swing or fall against a lattice structure. The lanyard is only as strong as the anchor point it is attached to. An inadequate anchor point will provide no protection at all.

Low Stretch Kernmantel Rope

Description
Low stretch and strong rope for use as an anchor line.

Criteria For Selection
Kernmantel nylon rope has a core of parallel or braided strands (the core or kern) surrounded by a tightly woven sheath (mantel). This modern design is flexible, easy to knot, strong for its diameter and hard wearing. The tightly woven sheath does a good job of protecting the core from UV light, cutting, dirt and abrasion. The term low stretch means that it can absorb a small shock load by extending a small amount, but when a large fall occurs the limited extension of this type of rope causes high impact forces on the body.

Conformity/loading Characteristics
EN 1891 - SWL around 200 kg when knotted.
Typically 30 - 40 kN depending on rope diameter.

Compatibility with Other Products
A fundamental component of many fall protection and rescue systems, although care is required in choosing appropriate components and configuration when used for fall arrest purposes. Low stretch rope should never be used in situations where a fall greater than fall factor one is possible (i.e. do not climb above the point of attachment).
Some rope may have a stitched termination.

Pre-use Check
Excessive wear, condition of sheath, cuts, abrasion, soft areas, signs of possible chemical contamination.

Installation, Fitting or Wearing
Cut ends should be heat sealed to join the inner and outer parts of the rope together.
Consult user instructions for use with rope devices.
Knots may reduce strength by up to 50%.

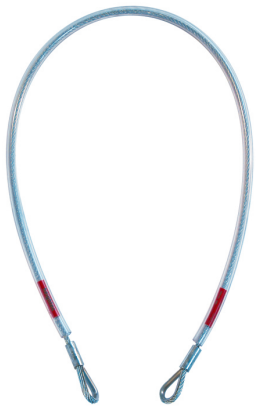
Methods of Use (Practical Requirements)
Avoid wear or abrasion over edges, sharp projections or other system components.
Ensure any anchor point is secure and suitably positioned for the required task.
Avoid gritty or degrading environments, e.g. chemicals, heat etc.

Specific Inspection, Care or Maintenance Requirements (if any)
Store ready for use in a clean, shaded, dry place away from sources of contamination.
Wash in mild detergent in cool water, rinse thoroughly and dry in a cool, dark place.

Identifying Defects
A tactile inspection should identify defects within the core. Withdraw from service if in any doubt.

Other Information
Ropes are fairly resistant to cutting when loose but are more prone to this when taut.
Drops or falls over sharp edges are especially dangerous. Do not stand on ropes. Do not leave on the ground where they can be damaged or contaminated. When used for descent, tie a stopper knot at the bottom of the rope above ground level.

Steel Anchor Slings



Description
Used in any situation for primary anchor point in fall protection or rescue system.

Criteria For Selection
Galvanised steel wire with PVC sheath to protect both wire and the structure to which the sling is attached.

PVC sheath also provides a grip to maintain the position of the sling if it is wrapped several times around the anchor structure.

Variable length.

Conformity/loading Characteristics
EN 795.
SWL 300 kg.

Compatibility with Other Products
Useful mobile anchor point for any fall protection system.

Pre-use Check
Presence of thimbles, integrity of plastic sheath, possible corrosion within sheath, cracked or broken wire strands, security of ferrules.

Installation, Fitting or Wearing
Read the manufacturer's instructions for advice on fitting and use.
Attach eyes together and connect directly into the connector used for this.

Methods of Use (Practical Requirements)
Connector used for closure should have both eyes at one end and connection to rest of fall protection system at the other end (e.g. rope, lanyard).
Beware of possible re-orientation of connector used for closure owing to tendency of eyes to spring apart (more apparent in smaller lengths). This could cause the connector to be loaded across the gate or threaded closure.
Do not loop doubled strop through itself.
May be used in line or around a structure in a loop

Specific Inspection, Care or Maintenance Requirements (if any)
See above for pre-use check. Wash in clean warm water and dry away from heat.

Identifying Defects
Note: Defects cannot be repaired by the user.
Retired or damaged equipment must be destroyed before disposal.

Other Information
Damage to the PVC sheath may not affect the strength or operation of the sling.

Webbing Anchor Slings

Description
Used in any situation for primary anchor point in fall protection or rescue system.

Criteria For Selection
Sewn nylon webbing sling with sheath to protect against abrasion.
Variable length.

Conformity/loading Characteristics
EN 795, EN 566.
25 kN breaking load.

Compatibility with Other Products
Useful mobile anchor point for any fall protection system.

Pre-use Check
No damage to webbing or stitching.
No contamination, cuts, abrasion.
Protective sleeve present and not damaged.

If the webbing is sleeved, slide the cover back as far as possible to inspect the inner webbing and stitch block. Inspect the sleeve around the area that cannot be seen, if this has been damaged then assume damage to the webbing underneath.

Installation, Fitting or Wearing
Pass the sling around an unquestionably sound anchorage.
Connect directly into the loop ends with a connector.

Methods of Use (Practical Requirements)
Connector should be correctly orientated to ensure the gate is not loaded incorrectly.
Do not loop doubled strop through itself as it will weaken the strop by 30%.
C an be used in line or as single sling.

Specific Inspection, Care or Maintenance Requirements (if any)
See above for pre-use check.
Wash in clean warm water and dry away from heat.

Identifying Defects
Note: Defects cannot be repaired by the user.
Retired or damaged equipment must be destroyed before disposal.

Other Information
Damage to the wear sleeve will not affect the strength and operation of the sling