ROPE ACCESS TRAINING MANUAL

Issue No. 002

This manual is not a substitute for practical training and should be used to supplement your practical IRATA training during your course, as well as acting as an aide memoir after your course. This manual should be read in conjunction with the following IRATA Publications:

- **International Code of Practice (ICOP) – this document all IRATA best on-site working practice.**

IRATA Training, Assessment & Certification Scheme – (TACS) – this document details training requirements for the various IRATA levels.

References marked in Blue: IRATA TACS V005 refer to the relevant guidance in the Training, Assessment & Certification Scheme. These references specifically guide the following:

Trainee: Individual learning outcomes – what you need to do
Trainer: Content and method of delivery – what you need to teach
Assessor: Performance indicators – what he needs to see

Your trainer has signed to state that he will deliver all relevant syllabus items in line with the content and methodology outlined in this manual.

It should be noted that there are many different techniques and items of equipment in use by IRATA member companies and that the techniques and equipment highlighted in this manual represent what we think is current best practice and the easiest way for you to learn. It is the responsibility of the individual to keep up to date with advances and evolution in technique and equipment throughout their rope access career. Indeed, as you progress you may well come up with some of your own solutions, above all:

ENJOY!

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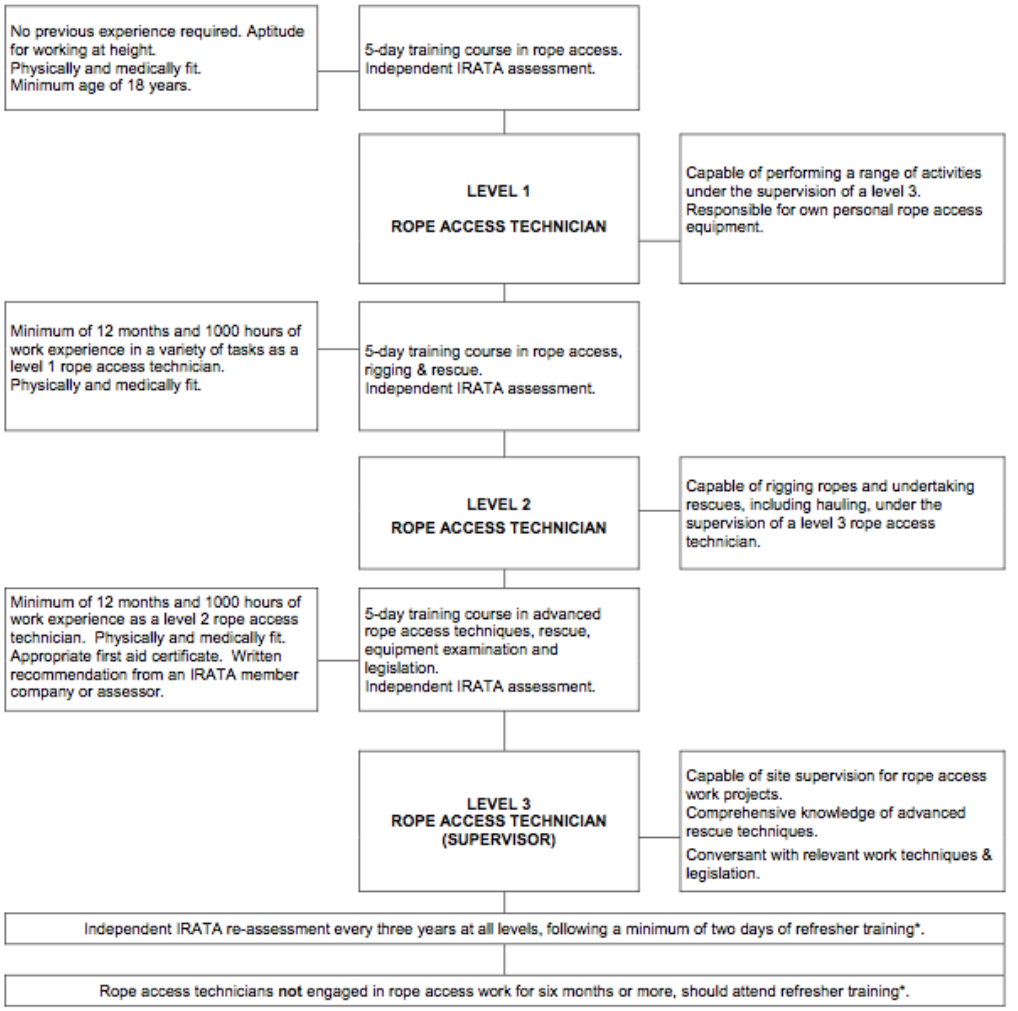
IRATA Training Scheme Flowchart



*Any level rope access technician undertaking re-assessment after the expiry of the current assessment would require a minimum of four days of training instead of the two days. Holders of expired level 2 or 3 certificates or others with questions should contact an IRATA training company for information on revalidation procedure. To ensure technicians are up to date with certification, re-assessment may be done up to 6 months before due expiry date without any time penalty.

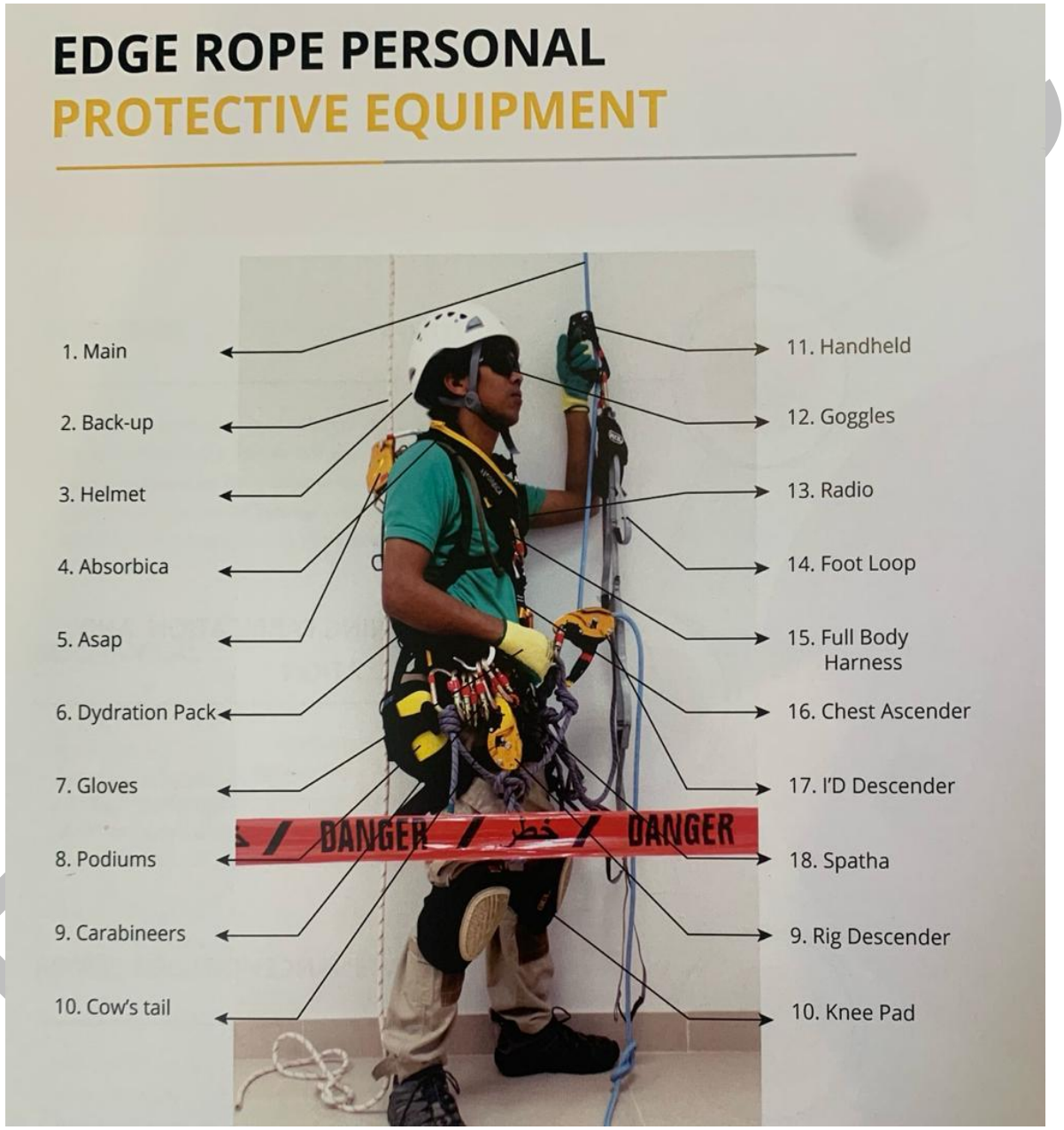
Logbooks

Logbooks are issued by IRATA on completion of your training course. It is important that you keep your logbook up to date; the logbook becomes your rope access c.v. The purpose of the logbook is not only to record the number of hours engaged in rope access activities, but also the type and variety of work undertaken. This is particularly important for rope access technicians wishing to upgrade to a higher level, i.e. 2 or 3, as it is likely to demonstrate the breadth of experience of its owner. The logbook contains the type of work undertaken e.g. cleaning/painting but should also describe the rope access techniques involved e.g. rope transfers/cow's-tailing. Logged hours should be a true reflection of the work engaged in rope access activities and will usually be less than the length of time on site, or on time sheets, as they exclude non-rope access work, meal breaks, waiting for permits or down time because of weather. Periods of work should be in units of no more than two weeks, or one offshore trip and should specify how many days were worked during this period. The logbook should always be confirmed by the Level 3 or site supervisor, who should log their name, signature and IRATA serial number. If you lose your logbook, you should replace it immediately and, where possible, obtain references for the hours lost. Where lost hours are required to move up a level, e.g. level 1 to level 2, you must obtain credible references to verify the hours they have lost.

EQUIPMENT

ASSEMBLY OF PERSONAL EQUIPMENT

IRATA TACS 6.3.5



SELECTION OF EQUIPMENT IRATA TACS 6.3

THE MANUFACTURER'S INSTRUCTIONS SHOULD BE REFERRED TO FOR FULL DETAIL OF RECOMMENDED USE AND OPERATIONAL LIMITS.

Work at Height Helmet

EN 397 (Industrial)
EN 12492 (Mountaineering)
Most of our helmets carry both these standards

Helmets should always be worn with chinstrap fastened.

This helmet will take side impact much better than a standard industrial site helmet and will be more likely to stay on in the event of a fall/impact because of the stronger Y shaped chinstrap.

Helmet has no peak so as to give all round vision.

Harnesses

Sit harnesses: EN 813 (Some harnesses incorporate EN 358 – Work Positioning Belts)
Full body harnesses: EN 361 / ISO 10333-1

A full body harness to EN 361 should be used if there is any "fall arrest" work being undertaken. This must be used in conjunction with shock absorbing lanyards to EN 354 and EN355.

Chest harnesses to EN 361 or EN12277 Type D must be worn with a 'Sit Harness'. Never use a chest harness by itself.

The harness is made of nylon and must be protected from chemical contamination or other substances likely to cause irreparable damage to the harness.

Ascenders (Jumar / Croll)

EN 567 / EN 12841, Type B

Ascenders are devices that are attached to and used to climb the rope. For use on low stretch or dynamic rope Ø 8 – 13mm of kernmantel construction only.

Actual strength on the rope of 4.2 – 6.5kN static loading before sheath damage occurs.

The frame may be used to clip into, as eye strength varies from 5 -20kN.

Ascenders must not be used in a shock load situation as rope damage or breakage may occur.

Descender

EN 12841 Type C / ISO 22159
For rescue only: EN 341. Note: Stop has EN 341 only, therefore requires assessment of "foreseeable misuse" for normal operations.

Descenders are devices, which attach the operative to the working rope and allow a controlled descent.

The Petzl Stop descender will begin to slip at 4kN on a 10mm Ø rope and 5kN on a 11mm Ø rope with a static load.

The Petzl I'D will begin to slip at 4.5kN on a 10mm Ø rope and 6.5kN on a 11mm Ø rope with a static load.

The Petzl Rig will begin to slip at 5.4kN on a 10.5mm Ø rope and 6.9kN on a 11mm Ø rope with a static load.

In a rescue situation where the load will likely exceed 150kg then an additional braking karabiner must be used. The braking karabiner may be used under normal operating conditions.

ASAP - Mobile Fall Arrester – Back-up Device IRATA TACS 6.6.2

EN 12841, Type A
Assessment of "foreseeable misuse" certain operations.

Installed on a lifeline, for example the Petzl ASAP mobile fall arrester follows the user automatically as he moves, whether on an inclined or vertical surface. In case of a shock or sudden acceleration, the Petzl ASAP's locking wheel will lock onto the rope and stop the fall. If necessary, the mobile fall arrester can be connected to an energy-absorbing lanyard when working farther from the lifeline. For use on 10.5 -13 mm Ø low stretch ropes.

As this is a mobile fall arresting device it must be connected to sternal (chest) or dorsal (rear) attachment point to keep the user upright in case of fall.
When used in **"Pick-off" / "Snatch"** rescue techniques the ASAP must be used with ABSORBICA L57 absorbing lanyard.

Connectors – Maillon Rapides

EN 362 / EN 12275

Maillons maybe substituted for karabiners where more permanent or semi-permanent attachments are required or where a multi-directional loading may occur. Use exclusively certified Maillons, only those which are marked to this standard are to be used for PPE.

They must be screwed completely shut i.e. no thread showing before being loaded. If they are not screwed fully shut then they will not achieve adequate strength.

Connectors – Karabiner (Krabs)

EN 362

The essential link in any safety system. Karabiners vary according to their shape, size and locking system. The size of the gate opening determines what they can be clipped to.

Karabiners should have a minimum 2-way action gate locking mechanism such as a screwed sleeve or automatic locking mechanism. Gates must be screwed or secured shut when in use.

Steel karabiners should be used when clipped to wire strops, bolts, cables or other anchorages that could cause damage to an alloy karabiner.

Take care to load along the long axis (top to bottom) as opposed to across the minor axis (gate), which is much weaker.

Karabiners are marked with the breaking load and not the safe working load used for lifting equipment.
Recommended minimum static strength for karabiner loaded across major axis with gate closed is 20KN.

Wire Strops/Slings

EN 795 or EN 566

Wire strops that are commonly used throughout the rope access industry are 7mm Ø plastic coated with swaged eye and thimble, which have a WLL of 5kN.

Tape Slings

EN 566 and/or EN 795

Breaking load is to be in excess of 22kN

Slings are normally made of nylon. They need to be kept and maintained in the same way as ropes.

Knotted slings are weaker than if they are stitched. Only stitched and certified slings can be used for PPE.

Pulleys
EN 12278

Static test of 15kN minimum strength or the value indicated on the pulley (between the attachment point and each sheave).

ROPES

Ropes form the critical link between the abseiler and the structural anchor point. Ropes used in industrial rope access for personal protective equipment are of kernmantel (kern = core and mantel = sheath) construction.

Knots weaken the rope by up to 50 %. Some knots weaken the rope less than others.

Ropes are made of polyamide (Nylon) but can be made from polyester or other man-made fibres and are susceptible to chemical attack, particularly by acids.

Care must be taken to avoid:

Contamination, abrasion points, excessive exposure to light/dirt or other harmful factors

Mechanical and some other types should be detectable by visual and tactile checking (i.e. running the rope through hands)
Nylon is affected by UV light e.g. sunlight and heat above 80°C.
It has 10-15% loss of strength when wet, which is regained when dry. It is not affected by mildew.

Avoid standing on the rope as this may cause damage by cutting on sharp or abrasive objects on the floor and may allow dirt particles to enter the core, which may cause damage by internal abrasion.

Look after the rope – your life depends upon it.

Store in cool, dark, well aired and kept loosely.

Ropes should retired after a maximum of 5 years or in accordance with manufacturers advisory period. The life expectancy of rope depends very much on the use that it is subjected to. A rope used by window cleaners will last longer than a rope used for geo-technical rock drilling squad.

Dynamic Rope
EN 892

Dynamic single ropes are available in diameters of 10.5mm – 11mm are most suitable. The breaking load of a dynamic rope is not given. The most important factor is the impact load. Dynamic rope stretches typically up to 12% over its length, in order to absorb and lessen the impact force of any fall. The EN test is to hold 5 fall factor 2 falls with 80kg at an impact force of less than 12kN by stretching and absorbing energy.

Cow's-tails (Anchor Lanyards)
EN 892

Cow's tails are used to connect the operative's harness to the safety or working rope (via the appropriate knots and suitable attachment points). They should be able to withstand any dynamic forces they may be subjected to, including those that may occur as a result of a failure within the suspension system. Cow's-tails are made of single dynamic rope of 10.5 – 11mm Ø. Cow's-tails should not be covered along the length with electrical tape, as there will be loss of dynamic performance.

Low stretch rope
EN 1891 Type A

The EN test is a minimum-breaking load of 22kN for type A ropes and a minimum of 5 fall factor 1 falls.

Impact forces of less than 5.3kN occur with a fall factor 0.3 with 100kg. The EN requirement is a maximum of 6kN.

Low stretch ropes are not suitable for dynamic loads.

Low stretch ropes are normally used for both the working rope and safety/back-up rope.

Generally low stretch ropes will stretch ropes will shrink between 5 - 10% in water after their first use. This helps to reduce sheath slippage.

This rope is designed to give minimal stretch, typically up to 5% over its length.

Working Load Limit (WLL)

The maximum load (as determined by the manufacturer) that an item of lifting equipment is designed to raise, lower or suspend.

Safe Working Load (SWL)

The maximum load (as determined by a competent person) that an item of lifting equipment is designed to raise, lower or suspend. For example when a sling is used in different configurations.

To work out the SWL of textile equipment (ropes, webbing slings) the minimum-breaking load is divided by a Factor of Safety of 10.

To work out the SWL of metal hardware (karabiners) the minimum-breaking load is divided by a Factor of Safety of 5.

INSPECTION AND MAINTENANCE OF EQUIPMENT

IRATA TACS 6.3.1 – 6.3.4

FOR FURTHER DETAIL REFER TO MANUFACTURER'S GUIDANCE AND IRATA ICOP ANNEX H

Inspection and maintenance of equipment is important part of the IRATA scheme of work. They generally fall into three categories.

- Pre-use Check – Which should be carried out before each use.
- Periodic Examination
- Thorough Examination

All PPE must be accompanied by technical instructions from the manufacturer giving specific details on:

- Instructions for use, storage, cleaning, maintenance and servicing.
- The capabilities and technical checks.
- The instructions on compatibility with other products.
- The limitations of use.
- The dates and periods defining the lifetime of the product

The equipment is inspected by a competent person and is certified on a six monthly basis. This complies with the Lifting Operations and Lifting Equipment Regulation 1998 (LOLER).
The competent person must be familiar with the equipment to be inspected, as it is essential that they can detect any variation from the norm of that particular piece of equipment.

Always refer to the manufacturers instructions on care and maintenance. Listed below are some general points to look for.

With all PPE make sure the ID number is present and it is within the recommended lifespan.

Helmets

Check both inside and outside the shell for wear, cracks, burns, deformation and traces of chemical substances. Check the condition of the cradle for sound fixing, tears and loose stitching etc. Check that all adjustable parts are fully operational without slippage and not damaged or worn. To clean, wash in water without solvent.

Harnesses and Webbing Equipment

Carry out a visual check of the webbing straps, check that they are free from cuts; any cuts in the webbing means an automatic rejection of the harness. Check for wear (fluffiness and stiffness), stiffness can come from repeated contact with chemicals. Check there is no burn or trace of chemicals, which damage visually the webbing. Check both sides of the webbing; pay particular attention around the central 'D' ring area. Check the condition of the load bearing stitching carefully, these are generally heavy duty stitching of a different colour to the webbing, check for cuts and distorted stitching. Check the condition of the buckles; check there is no deformation, cracks, or traces of corrosion.

Chemical damage to textiles is often difficult to detect until the rope or webbing begins to disintegrate and can therefore be missed during an inspection. White powdery residues on the surface of the textile or a notable change in texture may be an indication of this.

Any textile that has been subjected to chemical contamination should be withdrawn from service immediately. Information on the effect that a particular chemical has on textiles may be obtained from the equipment manufacturer.

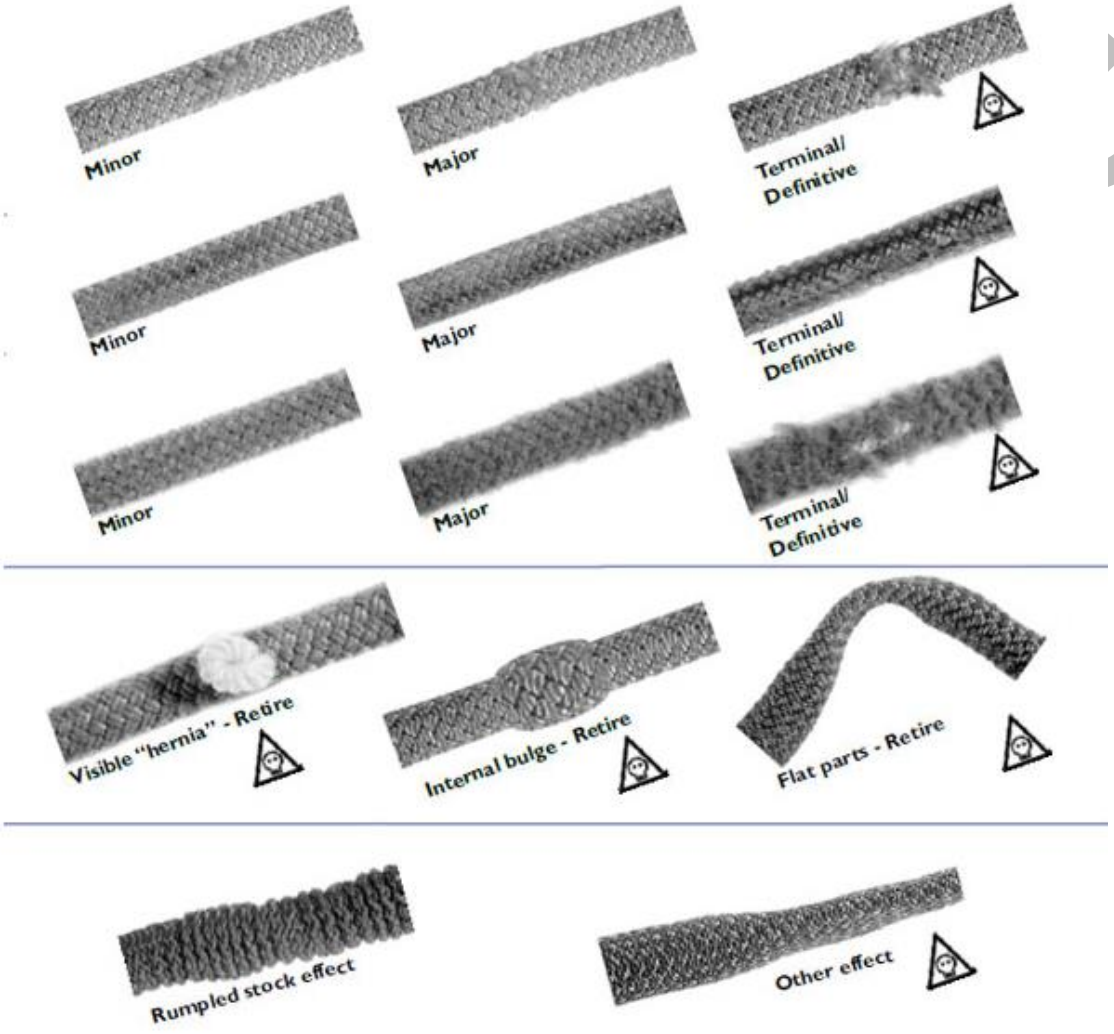
If in doubt, quarantine, destroy and dispose of the suspect equipment in such a way that it cannot be returned into service.

Cleaning & Maintenance: Wash by hand or machine, using a soap or detergent for delicate fabrics (within the range of pH 5.5 to 8.5) rinse with water (maximum temperature 30°C), then leave to dry slowly, away from direct heat source, in a well ventilated area. Webbing which has become wet then dried can shrink very slightly.

Ropes

Carry out a visual check of the sheath over the full length of the rope. Look for any evidence of cuts, wear, burning, fuzzy sections or traces of chemicals. Secondly carry a tactile check of the core by applying a curve of constant radius all the way along the rope, by hand. Look out for stiff sections, soft sections, and marked angles. An angle will allow you to identify a zone where the core is broken or deteriorated or will show a bulge in the core.

Cleaning & Maintenance: Wash by hand or machine, using a soap or detergent for delicate fabrics (within the range of pH 5.5 to 8.5) rinse with water (maximum temperature 30°C), then leave to dry slowly, away from direct heat source, in a well ventilated area.



Metal Equipment

Karabiners and Maillons: Visually check the body, look out for any cracks, marks, and check that it is free from deformation and wear. Any wear deeper than 1mm is serious. Check for corrosion. Check the hook and gate and that they align correctly, check the effectiveness of the return spring. Check and ensure that the locking system works properly.

Ascenders: Check the condition of the body is free from cracks and deformities. Check the condition of the cam, inspect the condition of the rivet, and check the black catch springs back in place. Carry out a function check on a rope.

Descenders: Check the condition of the fixed and moving side pieces, check for marks, cracks, wear, corrosion and deformation. Pay attention to the where the rubbing of rope takes place and to the holes used for connection. Check the condition of the friction components, check the condition of the grooves – sharp edges or holes in pulley are signs of extreme wear. Check the effectiveness of the return springs. Make sure the connection clip returns automatically. Carry out a function test on a rope.

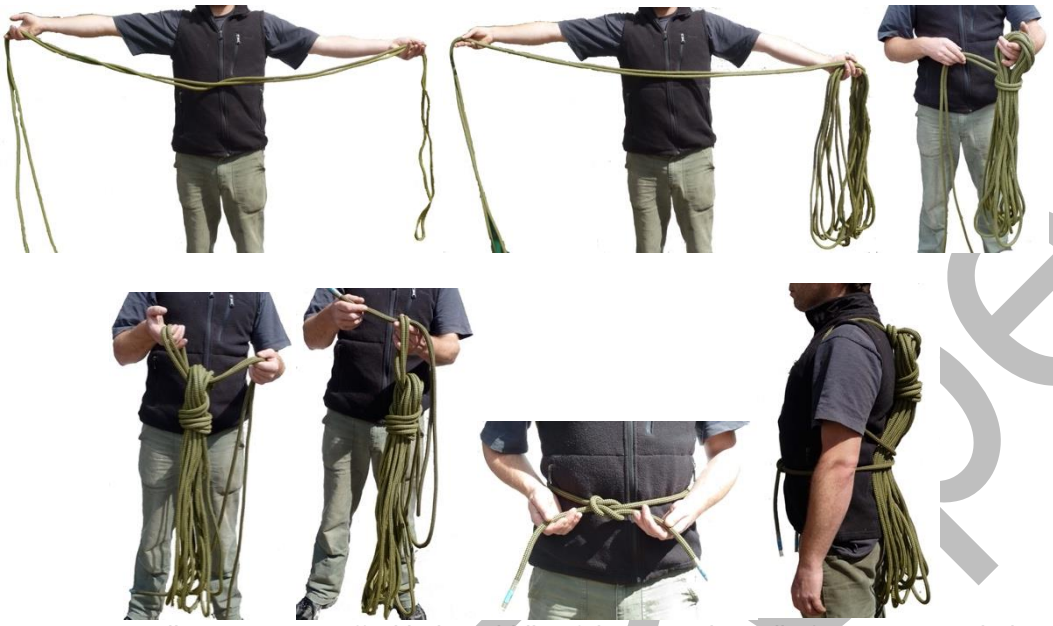
Cleaning & Maintenance: Metal equipment can be cleaned by submerging in clean hot water and using a detergent or soap which must afterwards be thoroughly rinsed with water. A drop of oil applied regularly to the mechanism (pivot, spring etc.) will ensure better operation

Equipment should be stored in a dry, well-aired environment away from direct sunlight, other sources of excessive heat, away from any chemical contaminants and away from anything, which could cause damage. Equipment should not be stored wet.

For further information on PPE inspection, the Petzl website has a good resource of information including videos of how to inspect their equipment.

COILING AND BAGGING ROPES: IRATA TACS 6.4.3

Coiling a rope



The most common way to coil a rope, start off with the middle of the rope, the coil of rope can carried on your back and is secured with a reef knot.

Daisy/Chain linked

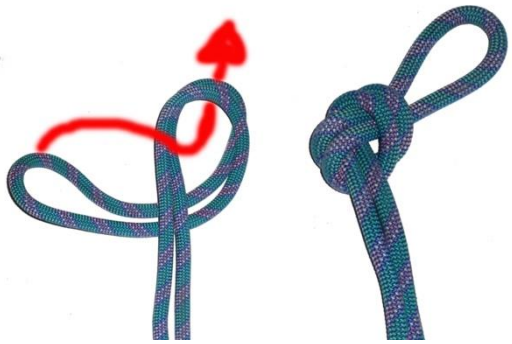
One of the advantages of daisy/chain linking ropes is, if the ropes are wet and hung up in this manner to dry, air can circulate around the rope drying them.

There are several different ways of starting the chain link, perhaps the most fool proof way of getting it right, is to start off with the middle of the rope:

- tie on overhand knot, this also prevents others from untying the rope from the wrong side
- pass a loop of rope through the overhand knot loop to your hand
- repeat this process, until you come to the end, to secure pass the tails of the rope through the final loop.

Bagging ropes for descent
For long abseils, it can be an advantage to bag the ropes for descent. To do this secure the tail ends of the rope to the bag by means of a barrel knot or bowline, feed the ropes gradually into the bag, secure the bag onto harness or workseat, as you abseil down the rope you can pay out more rope. The rope should deploy with ease, with no knots or tangles.

KNOTS: IRATA TACS 6.4.3



Overhand knot on a bight is the simplest knot that forms a secure loop in the rope. It is very easy to tie but very difficult to undo after loading.

Uses: general hauling of work equipment

Loss of strength: 30-40%

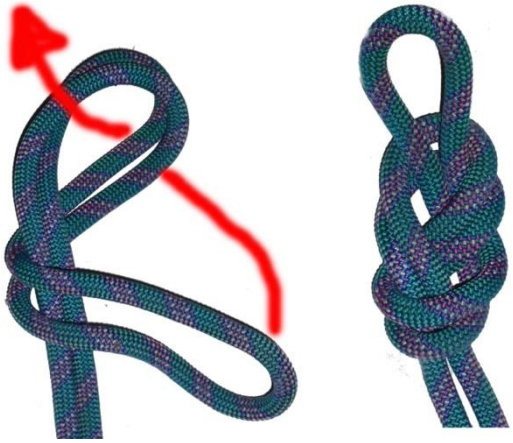
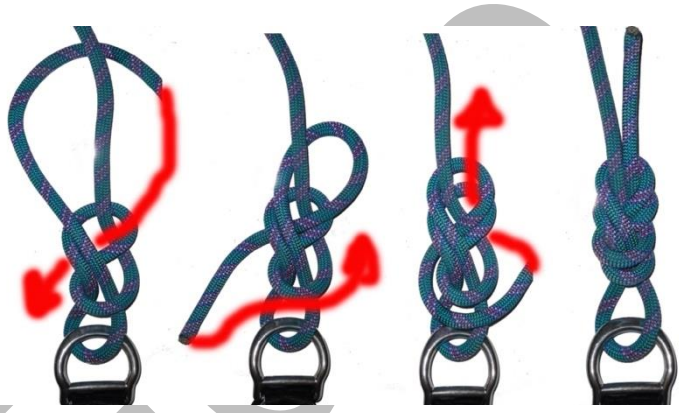


Figure of 8 on bight by adding an extra half-turn to a overhand knot creates a figure of 8 on a bight. It is stronger and easier to undo than the overhand knot while still being of fairly low bulk.

Uses: on cow's-tails, attaching to main anchor

Loss of strength: 25-35%



Rethreaded Figure of 8: This is the rethreaded version of the above knot.

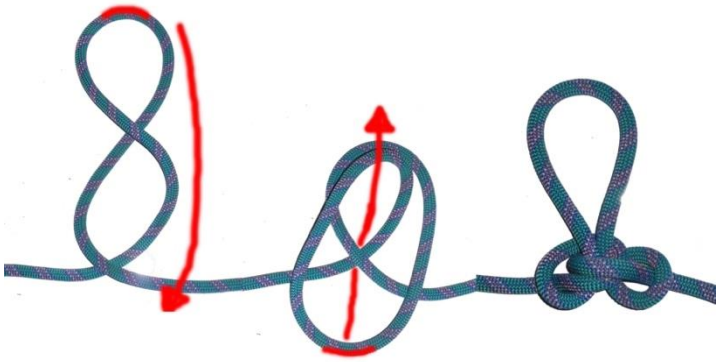
Uses: It is used to attach cow's-tail to main 'D' ring on harness

Loss of strength: 25-35%

Double figure of 8 on bight (bunny ears): This knot creates two loops that can be used to connect to two anchors.

Uses: small 'Y' hangs

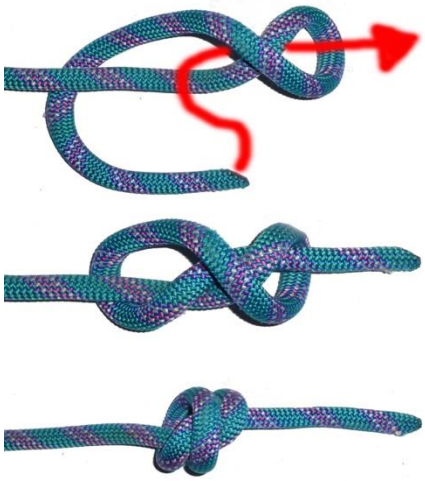
Loss of strength: 25-35%



Alpine Butterfly: This knot is frequently used as it can be used to create a loop in the middle of a rope and can accept loading in any orientation without deformation.

Uses: isolate damaged section in ropes, 'Y' hangs, 3-way loading.

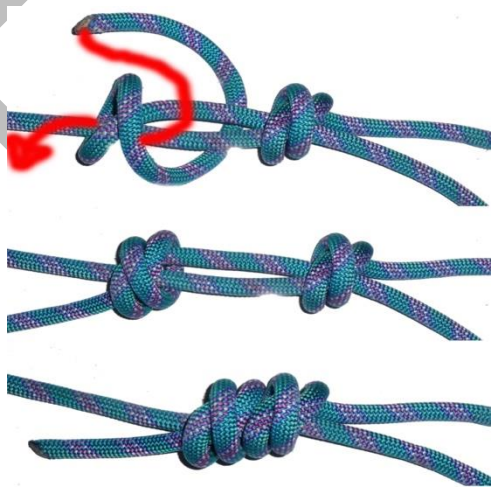
Loss of strength: 25-35%



Stopper Knot: Usually tied approx 1m from the end of the rope.

Uses: prevents the abseiler from abseiling off the end of the ropes

Barrel Knot: This is commonly used in cow's-tails, as it is small and forms a slip loop that tightens around the karabiner, holding it in the correct orientation. Due to its slipknot nature, it has good energy absorbing abilities, and gave the lowest impact forces in the knotted cow's tails dynamic tests.
Uses: on cowstails
Loss of strength: 25-35%



Double Fisherman's Knot: This is very difficult to untie if it has been heavily loaded.

Use: joining 2 ropes of identical diameter together

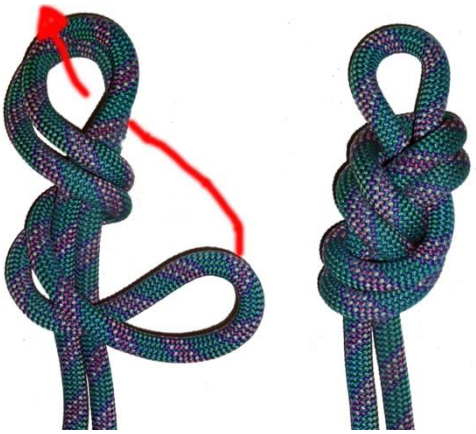
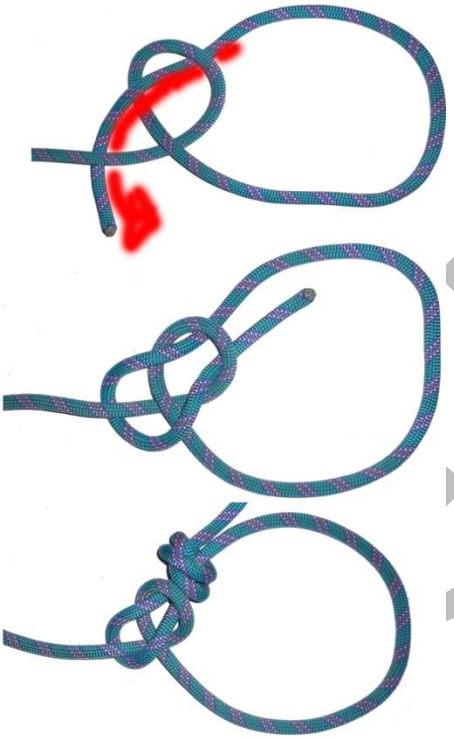


Figure of 9 on bight by adding another half-turn to the figure of 8 on a bight creates the double figure-of-nine. It is slightly stronger again and even easier to undo.

Use: for attaching rope to anchor points.

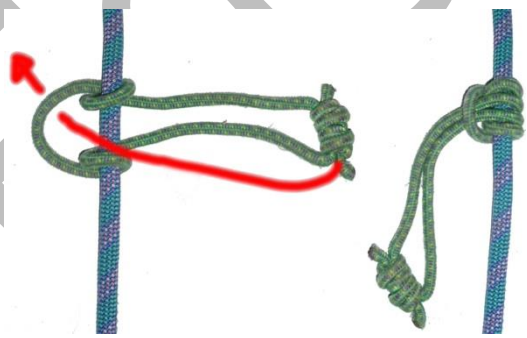
Loss of strength: 15-30%



Bowline: A common, versatile knot, quick to tie and very easy to undo. Must be dressed with additional stopper knot to prevent slippage.

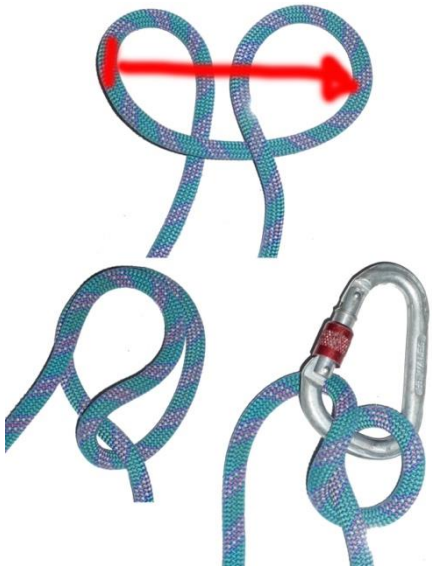
Use: attaching around larger anchors

Loss of strength: 30-45%



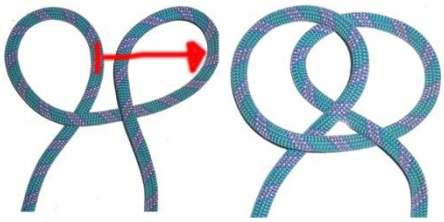
Prussik knot: used in the same way as ascender, can be used to climb the rope if no other mechanical means are available. In reality this should never be the case.

Use: used to attach rope protection to rope and to support the weight of work tools e.g. air hoses.



Italian Hitch is a sliding friction hitch and should be used with a larger HMS karabiner and tied off with 2 half hitches. Very simple and effective but does tend to kink the rope. To tie fold loops together like a book.

Use: as a releasable tether.



Clove Hitch
Use: to secure a rope directly to a connector, post or bar, it does not create a termination loop but instead grips the anchor directly. To tie slide right loop behind left.

RIGGING

Anyone using industrial rope access techniques (i.e. where the rope is used as the primary means of support or positioning) must be attached to two independently attached ropes. The main working rope will be used for primary support using a descender or ascenders, whilst the other rope will be used as the safety or back-up rope. Each rope should have its own separate anchor system. Ropes should be rigged so that if one rope should fail, a shock load would not be passed on through the system.

ANCHORS

All anchor points used in rope access should be unquestionably reliable and capable of withstanding any potential loads to which they may be subjected.

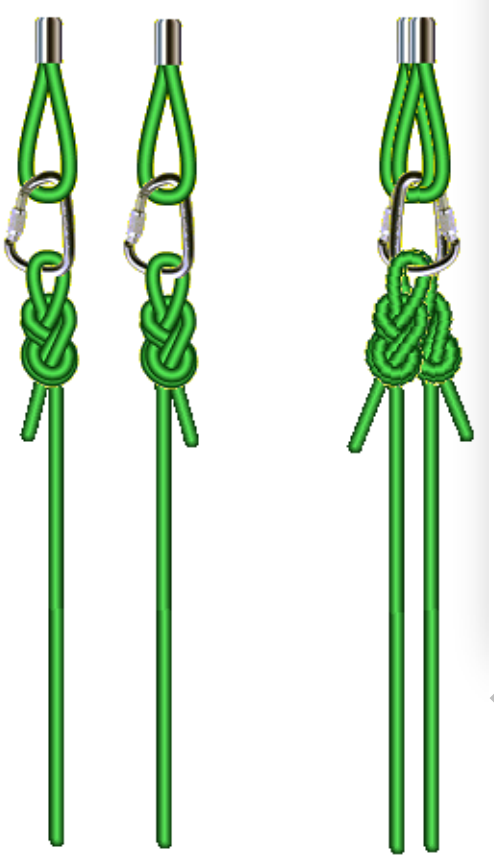
Examples of suitable anchor points could be structural steelwork, lift-shaft housings on tower blocks, suitably tested mechanical and chemical anchors, sound concrete features, deadweight anchors, substantial geological features and large trees. When attachment is made to a structure and it is apparent that the structure has more than adequate strength, it is still advised to attach each anchor line to separate anchors, e.g. via two anchor slings.

The strength of main anchor points should be at least as strong as that of the ropes attached to them and not less than 15kN. To determine the minimum anchor strength requirement, IRATA's code of practice uses a safety factor of 2.5. The maximum permissible impact force on the user in the event of a fall should not exceed 6 kN; therefore, the static strength of all anchors, should be at least 15 kN. Deviation anchors and anchors placed simply to maintain the position of the anchor lines may have a lower static strength than this, but should be sufficient for the load that could be applied.

Anchors of the type that are fixed in masonry should only be installed and inspected by competent persons, who are aware of the numerous safety issues, e.g. minimum distance required between two fixed anchors, minimum distance from any edge, correct depth, solid or hollow masonry. Where possible, anchors should always be installed so that they are loaded in shear. In the case of eye bolts or other types of temporary anchors, where the strength of a single anchor may be inadequate, the minimum required strength of 15 kN may be obtained by linking and equally loading two anchors or more. In this case, it is essential that both anchor lines are attached to both anchors. This can be achieved, for example, by the use of a double figure-of-eight knot on the bight (bunny knot) or a combination of a figure-of-eight knot on the bight and an alpine butterfly knot.

The static strength of each anchor line including terminations (e.g. sewn and knotted) should be a minimum of 15 kN.

BASIC ANCHOR SYSTEM: IRATA TACS 6.4.4



Examples of basic anchor systems.

The most common knots used here are the figure of eight on a bight and figure of nine on a bight.

Each anchor system is independent of each other.

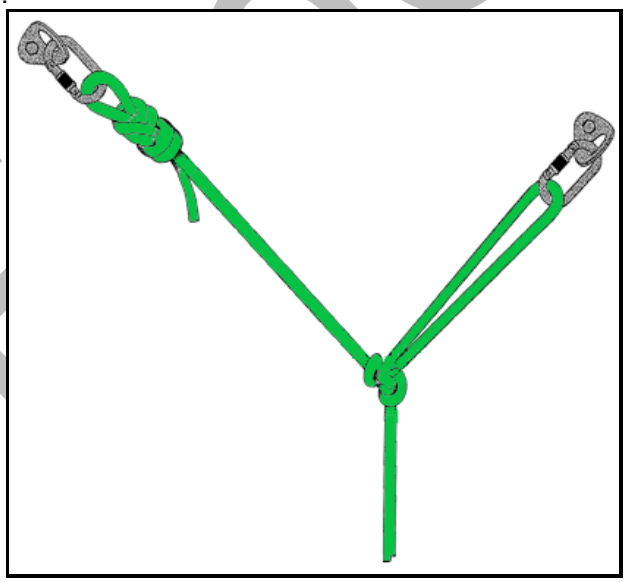
Karabiners should be orientated so that screw gate is threaded downwards, this allows for any gravitational movement to screw gate closed.

In some work environments such as hot works/blasting it may be worth considering rigging the back up rope slightly apart from the working rope.

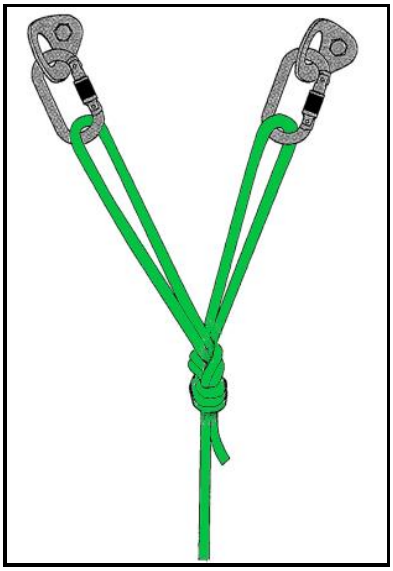
If the anchor points are directly over the worksite then the bights of both knots can be attached into both karabiners for added security. Note how the karabiners are opposing each other (back to back), as the gates do not interfere with each other.

'Y' HANGS: IRATA TACS 6.4.5

'Y' Hangs can be rigged where the anchor points are not directly over the worksite. The ropes are attached to both anchors and the load is shared evenly between both anchor points. The crucial element in this rigging method is the angle of the 'Y'.



'Y' Hang with Figure of 8 and Alpine Butterfly. Which is easy to adjust for lateral movement.



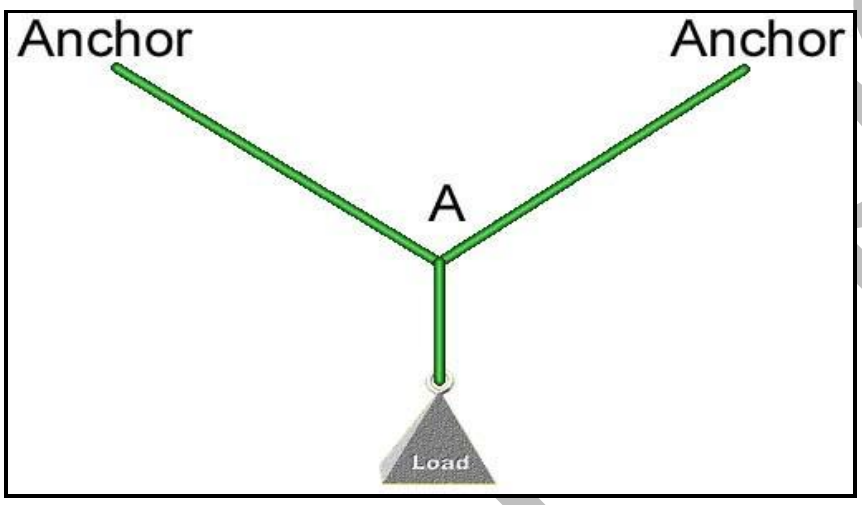
'Y Hang with Double figure of 8 on a bight (Bunny Knot)

At angles less than 90°, the load placed on each anchor point is less than the load on the rope. 90° is the recommended maximum angle for rigging, less is best.

At the angle of 120°, the load on each anchor point is equal to that of the load on the rope.

At angles greater than 120°, the load placed on each of the anchor points is greater than the load placed on the rope. 120° is therefore the critical angle when rigging ropes, it is essential that rigging angles should never exceed 120°. When the angle increases, the load on the anchor increases.

Where the anchor points for a 'Y' hang are located a reasonable distance apart then consideration should be given to the effects of the failure of one of the anchors (e.g. a swing likely to cause personal injury). This can be overcome by using 2 anchors at each side of the 'Y' Hang; thereby preventing a swing should any one element of the system fail.

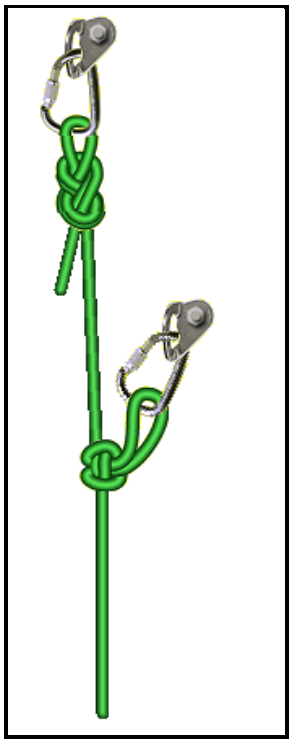


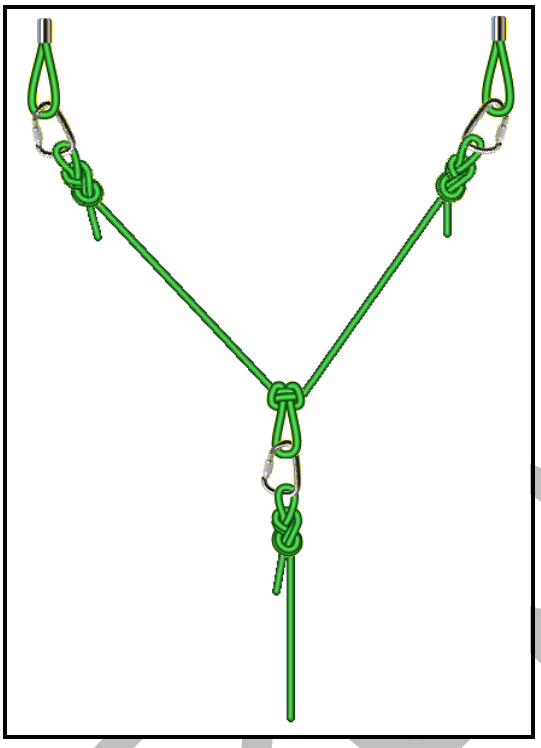
The following angles of the 'Y Hang' will produce the resulting anchor point loading when a load of 100 kg is applied:

Angle 'A' of 'Y' Hang	**0°**	**60°**	**90°**	**120°**	**140°**	**150°**	**160°**	**177°**	**179°**
Anchor point load in kg	**50**	**60**	**70**	**100**	**150**	**200**	**300**	**1915**	**5747**

Note: By exceeding 160° in a 'Y' hang, the SWL of a typical 10.5mm Low Stretch Rope would be exceeded when a load of 100kg is applied.

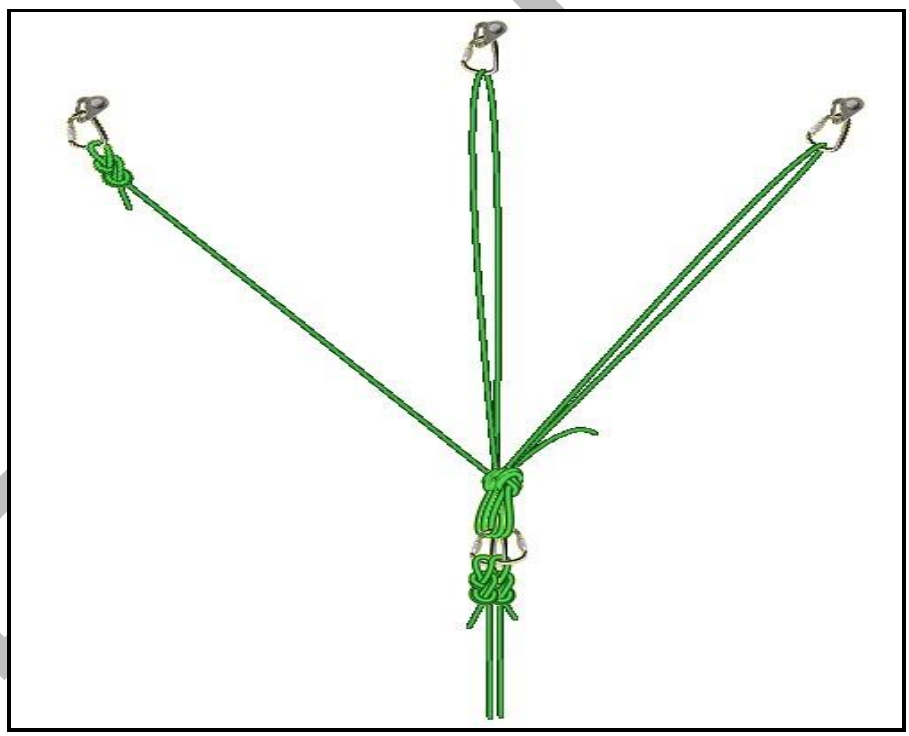
In-line ‘Y’ Hang equalizing load between 2 vertical anchors.





An example of using a separate rigging rope to set up a ‘Y’ Hang using an Alpine Butterfly to attach the working and safety ropes to.

Note: examples are shown singularly for illustrative purposes and should be doubled up to create safe working system.



MULTIPLE ANCHOR EQUALISATION (Cordellete / BFK)

For joining 3 or more anchors together. Locate all the anchors, attach slings and karabiners, and start by attaching a figure of 8 or 9 to furthest karabiner, the rope is then clipped into the remaining karabiners. The ropes between the karabiners are pulled down and equalised. A big overhand knot is tied.

ROPE AND SLING PROTECTION: IRATA TACS 6.4.6

Sharp edges and hot surfaces must be avoided at all costs. Bad rigging resulting in contact with these surfaces is one of the greatest dangers to the rope access technician. Either can result in sudden and immediate catastrophic failure of the rope system.

It is an essential part of pre-work planning and risk assessment that any threat to the integrity of the rope system is identified and dealt with in an unquestionably effective manner. The intended path of the ropes must be scrutinised in detail from top to bottom. In addition, the possibility of sideways, or lateral, movement of the ropes during operations must be carefully considered and the effects of this movement protected against.

Where possible every effort should be made to use rigging solutions in order to keep the ropes away from sharp or hot surfaces. Common options include Y-hangs, Deviations and Re-belays. Additional rope protection may also be required to protect the ropes against the effects of sideways, or lateral, movements during operations.

Where it is not possible to avoid contact with hazardous edges then effective rope protection must be deployed. Canvas “rope protectors”, despite their name, are often not sufficient by themselves to offer adequate protection from aggressively sharp or abrasive surfaces and additional measures must be deployed to ensure unquestionably reliable protection to the ropes.

Particular care should be taken when passing rope protection to ensure that levels of protection are not compromised when opening and closing protection.

In order to offer sufficient protection the surface or edge should be increased to greater than 5mm and covered with a layer of suitable and sufficient padding, in addition each rope should have its own rope protector. Canvas rope protectors should be attached to the ropes with a solid link, i.e. directly connected to an Alpine Butterfly knot (prussik knots, although commonly used to attach rope protectors are subject to interference and a non-expert technician is at risk of not re-installing the protection properly resulting in the protector detaching and falling down the rope, thus rendering it useless). Wire sling bypass arrangements may also be considered as a further layer of protection.

Edge rollers and protective edge plates may also be considered as an alternative to canvas rope protectors. These should also be in addition to suitable and sufficient edge padding and subject to the measures described above.

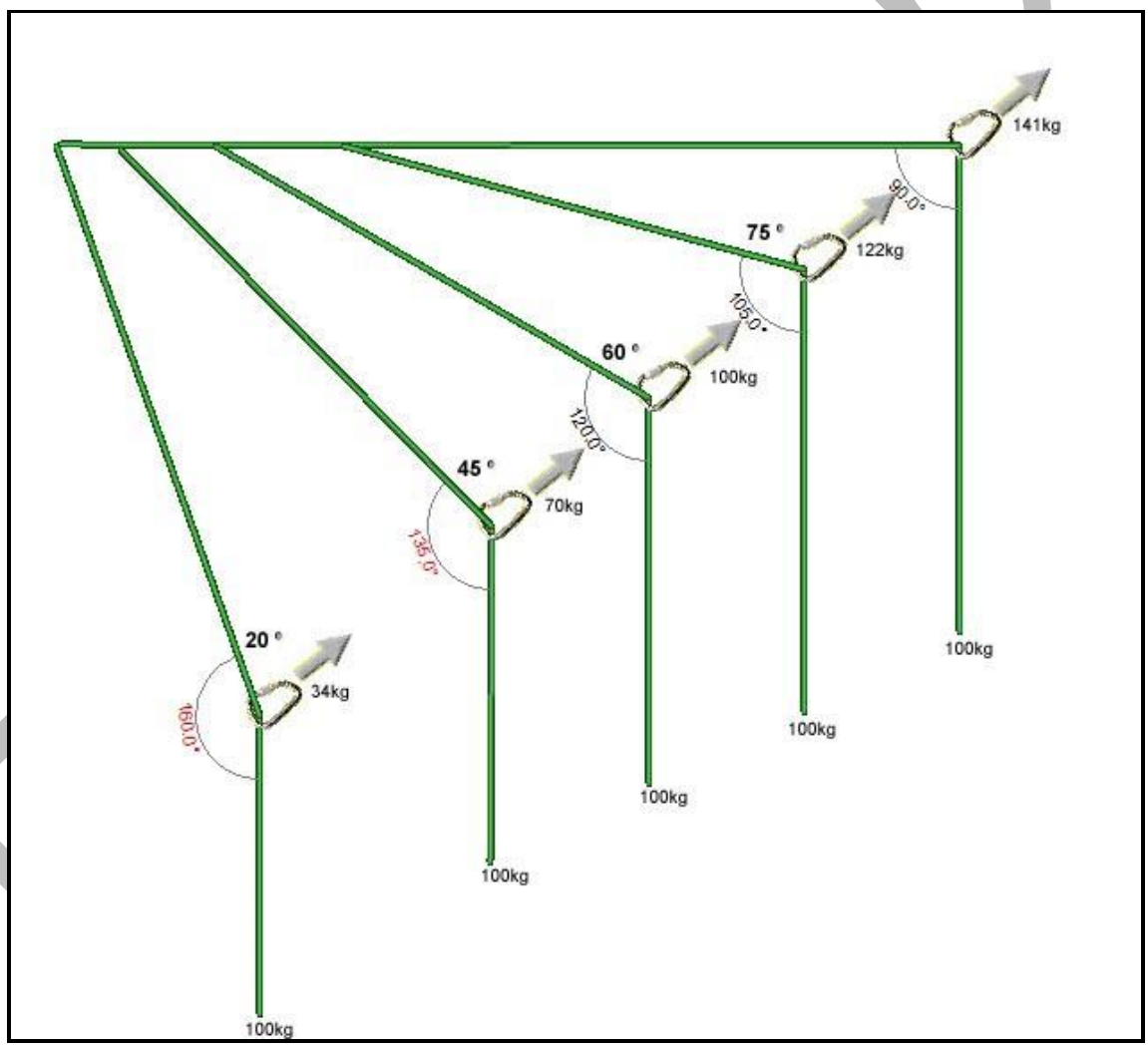
DEVIATIONS: IRATA TACS 6.4.8

Deviation anchors should be full strength slings anchored to the structure.

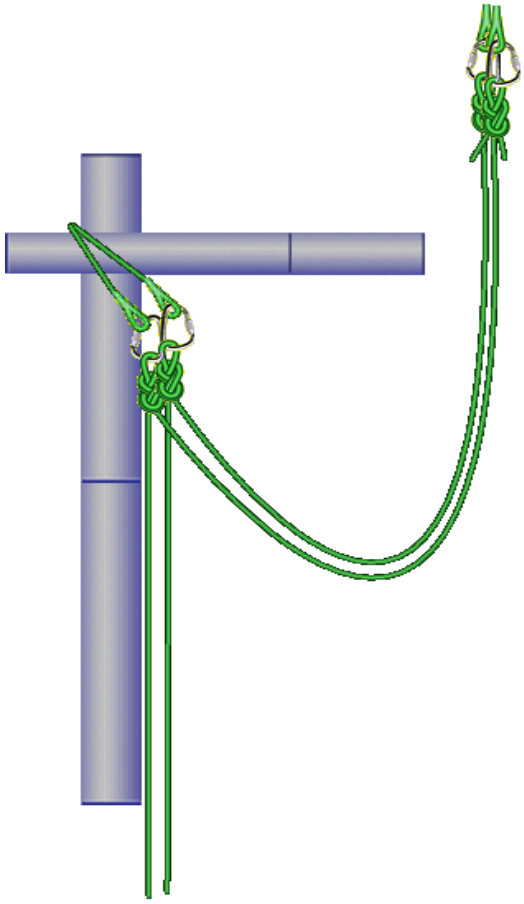
Deviation anchors have two main purposes:

- To position the technician on the workface. In these cases a single deviation anchor may be appropriate, i.e. where the consequence of anchor failure would be a small swing, which has no potential for injury or rigging damage. A single deviation should not exceed 20° from the vertical.

- Double-anchor deviations may be used to deviate the ropes by a greater angle and distance than a single anchor deviation, and / or may allow the ropes and user to be protected against more serious hazards such as a sharp edge or a large swing into a structure. Such a deviation utilizes a double anchor system, with suitably rated anchors and connection components, to provide protection against failure of any one item. Where a large angle is created, users should consider whether a re-anchor may be more appropriate.



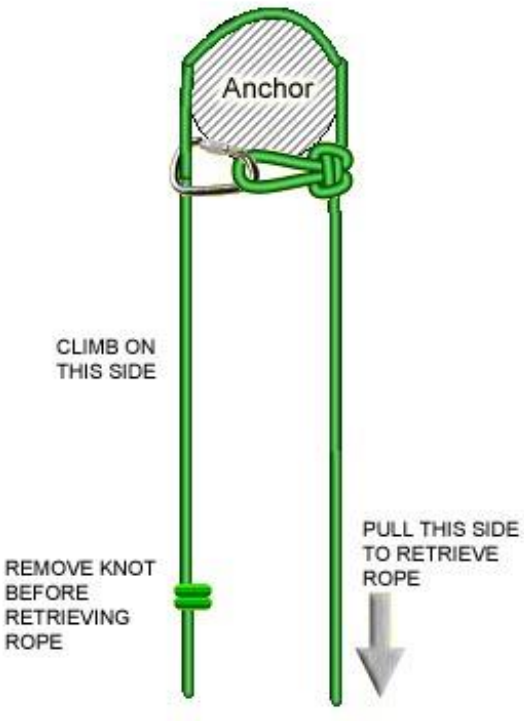
RE-ANCHORS (ALSO KNOWN AS REBELAYS): IRATA TACS 6.4.7



A re-anchor (commonly called a re-belay) is a secondary set of anchors installed at any distance below the primary anchors. Ropes may be re-anchored for a number of reasons, including positioning the ropes for work, avoiding hazards, or to reduce rope stretch. Basic requirements for strength and rigging methods are the same as for the primary anchors.

Re-anchors can be used to avoid sharp edges, hot pipes etc, and to allow access underneath overhanging roofs/walkways. Where there is potentially a lot of rope stretch in the system, the ropes can be re-anchored at suitable intervals. When rigging the re-anchor consider a large enough 'loop' to allow for access and rescue and to avoid the ropes from abrasion from any hazard above. Generally, shallow re-anchor loops make both access and rescue more difficult, particularly where the offset is large.

RETRIEVABLE RIGGING (ALSO KNOW AS PULL THROUGHS): IRATA TACS 6.4.9



A pull through can be set up to allow access and egress. They should be considered to be temporary rigging and, therefore, are not normally considered appropriate for rescues.
This system requires extreme caution. It is important that that the rope technician carefully checks that he/she is connected to the correct side of the system. Ropes on both sides must reach the ground.

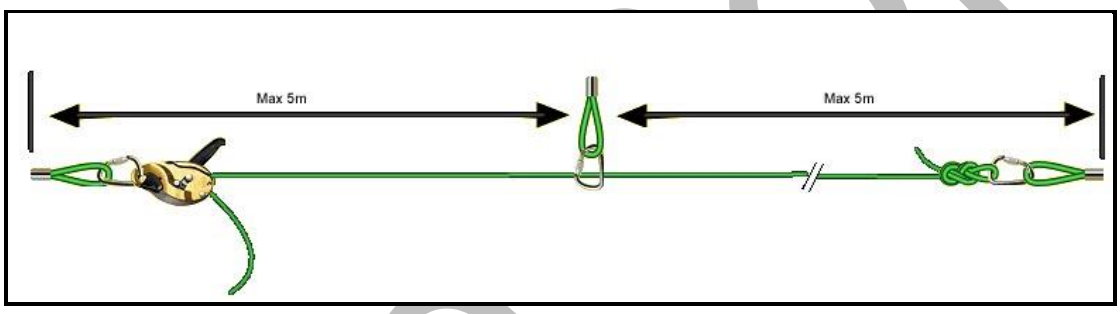
The example is shown singularly and must be used with a second system. The retrievable rope side is not suitable as a back up.

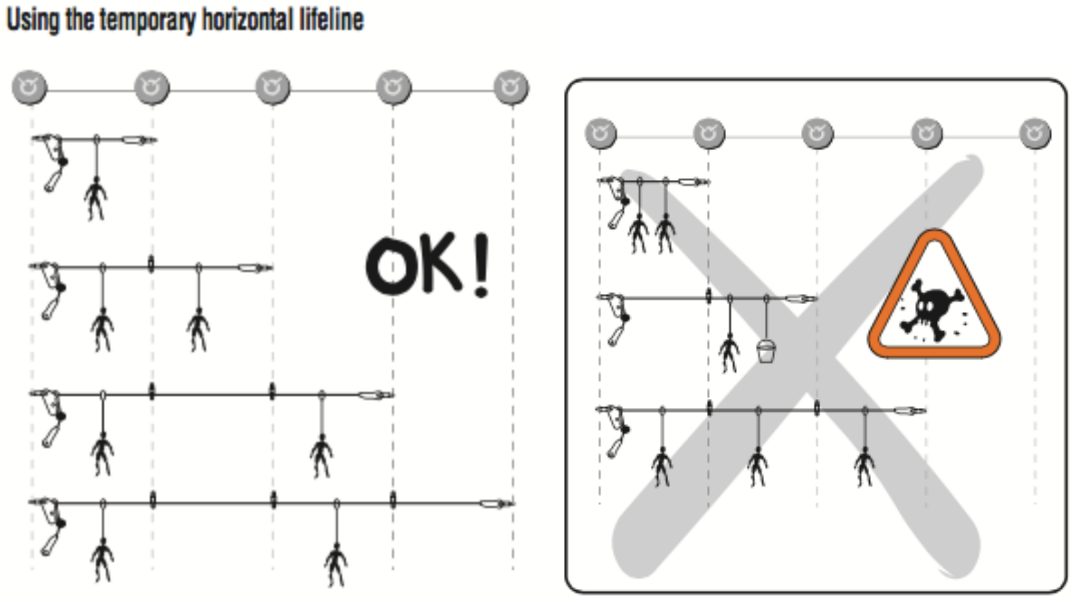
Remove any stopper knots from the climbing side of rope before retrieving ropes. Rope protection maybe required for the rope running over the anchor.

HORIZONTAL LIFELINES: IRATA TACS 6.4.10

The main consideration when setting up a horizontal lifeline is the effect of angle loading on the system in the event of it being loaded. The load on the lifeline and the anchors may be up to three times the load imposed on it. Here are some points to consider when rigging a horizontal lifeline:

- Solid anchor points should be selected at each side of lifeline. Minimum 12kN
- Intermediates anchors placed maximum of 5m apart.
- The lifeline should run freely through the intermediate anchors (not knotted).
- The rope should be hand tensioned through the descender and locked off.
- The maximum allowable incline is 15°. Anything above 15° should be treated as a vertical lifeline.
- The lifeline should be rigged as high as possible in relation to the user to minimize potential falls.
- Maximum of 2 people per lifeline.

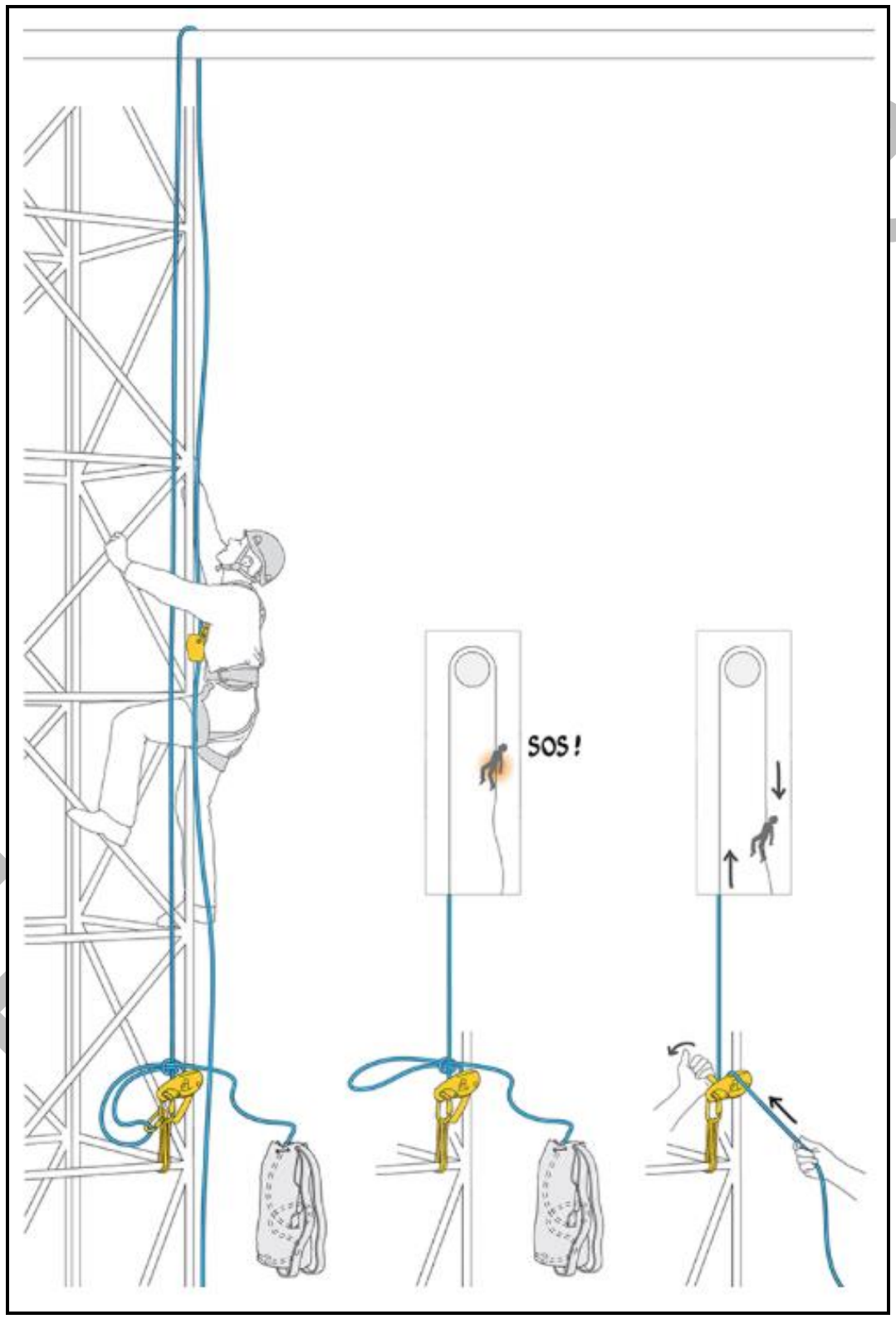




VERTICAL FALL ARREST SYSTEMS: IRATA TACS 6.4.11

On certain structures (e.g. fixed ladders) it may be appropriate to rig a temporary fall arrest system for ease of access.

An example of a system that allows the rope to be installed from below, by throwing, with a pre-installed rescue system



TENSIONED ROPES: IRATA TACS 6.4.12 & 6.8.9

Horizontal Tensioned ropes (also known as a Tramway)
These can be used in many different scenarios, from transporting equipment / casualties between two areas, to working suspended from them under structures such as bridges.

It is crucial that to consider the forces exerted on the ropes and anchors (see angle loading diagram above).

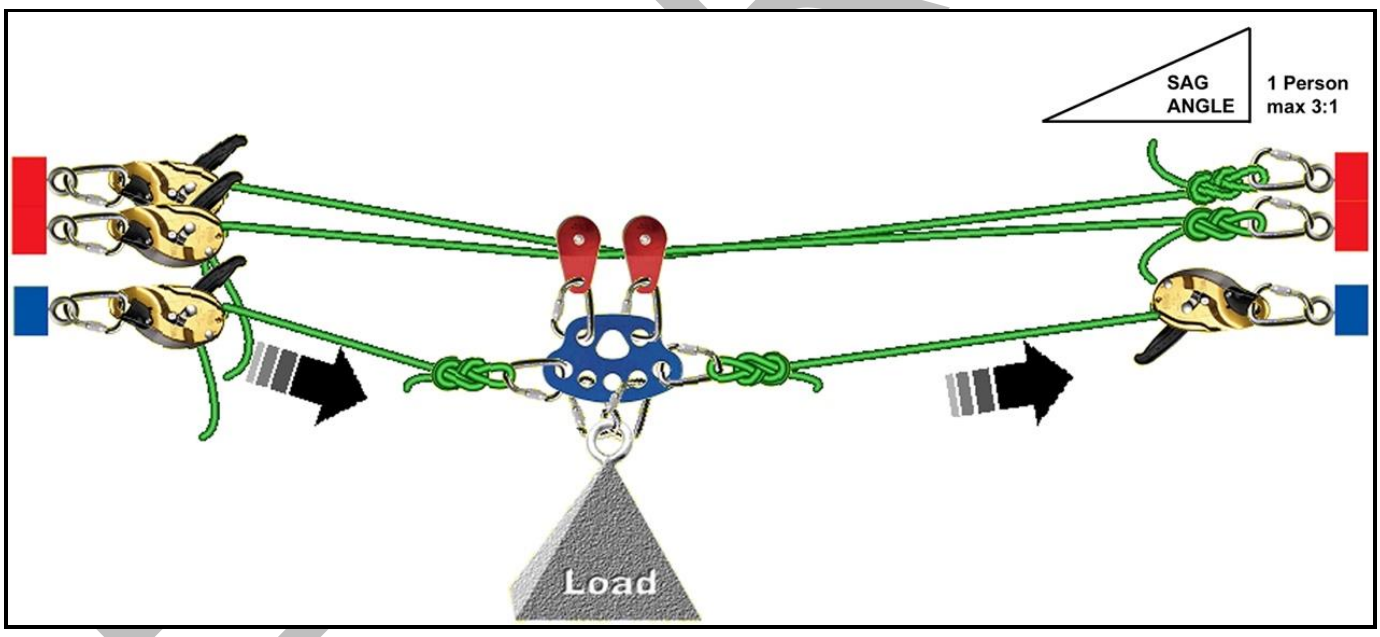
The tensioned ropes must in incorporate a SAG angle, to do this; we follow a simple rule of one person tensioning the system through a maximum of 3:1 pulley system. By incorporating the SAG angle we should not be able to over-tension the ropes, and therefore staying within the SWL's of the equipment.

The tensioned ropes are used in pairs and equally tensioned by one person, the load connected to the ropes is shared between both ropes, if any one part of the system was to fail then should be no shock loading of the system.

The load is connected to the tensioned ropes using pulleys; an additional rope is connected to both sides of the load for directional movement. It is important that load remain supported on the tensioned ropes and not by directional ropes.

The ropes are attached to the anchors on one side by means of descenders; this allows the ropes to be released and lowered if necessary and therefore making a rescue from the tensioned lines more straightforward.

The maximum allowable incline is 15°. Anything above 15° should be treated as a diagonal tensioned ropes system.

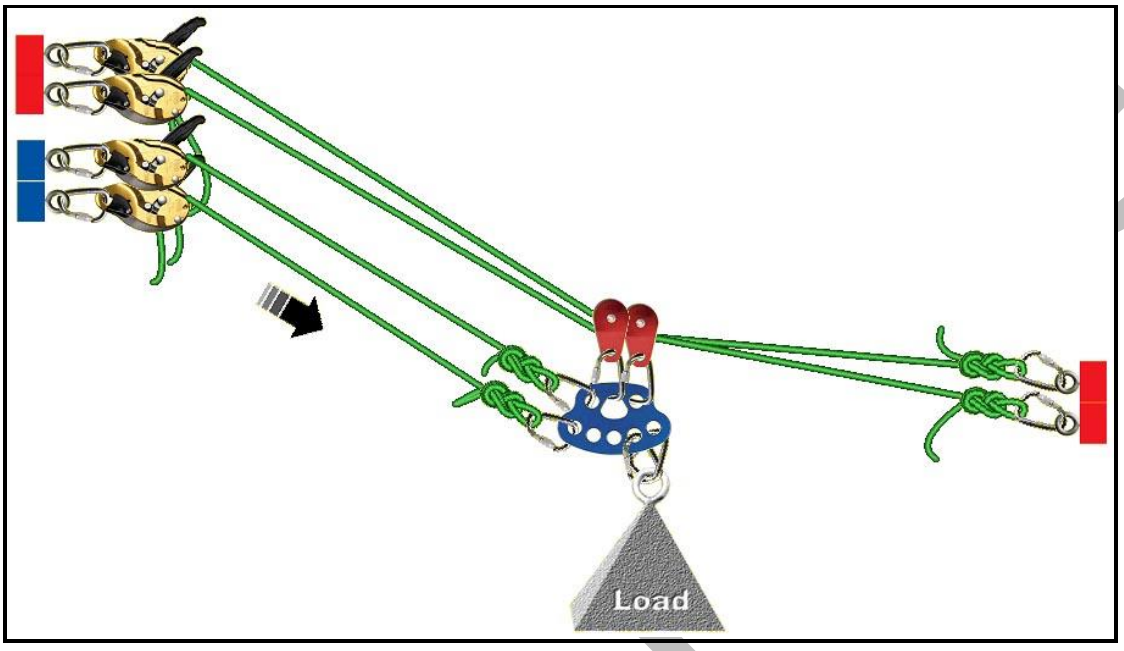


Diagonal Tensioned ropes

Diagonal tensioned ropes are rigged exactly the same as the horizontal tensioned ropes except they can be rigged at any angle.

The load on the tensioned ropes must be connected to two extra ropes (working rope and back-up rope).

The diagonal tensioned ropes can be tensioned or released to allow redirection of the path of the load. If the ropes are de-tensioned whilst lowering a load, the load can be re-directed straight down.



RIGGING FOR RESCUE AND HAULING SYSTEMS: IRATA TACS 6.5 & 6.9

Under the Work at Height Regulations 2005, a rescue plan should be in place for recovering any team member that becomes incapacitated whilst working at height and should be identified at the 'Risk Assessment' stage, before any work commences and should be fully described in the 'Method Statement'.

In any rescue the main principals are to always have a back-up, have the correct equipment to carry out the rescue and ensure that all rescue team members fully understand the techniques involved.

If the rescue scenario is particularly complicated then a practice rescue should be carried out to ensure the proposed rescue method could be successfully completed within an acceptable time span. Consider rigging for rescue, is it possible to lower the casualty to safety, or is a haul system in place to recover the casualty. Basically the ropes you rig on site are ropes you have to rescue from. Keep potential rescues as simple as possible, starting with the rigging.

A rescue and recovery kit should accompany all rope access teams. This will include sufficient equipment to rescue a technician from any of the rope access situations in which they may be operating. Dedicated rescue equipment should not be used for anything other than a rescue.

Before commencing any rescue it is important that the cause of the casualty's accident is fully understood, so that these conditions do not effect the rescue team, for example if the casualty is unconscious through gassing.

Consider the position of casualty vs. the rescuer, in some scenarios it would be better casualty management for the rescuer to be beneath the casualty as this allows the rescuer to walk or push away from the structure with their legs.

- Ensure the rescuers do not endanger themselves whilst carrying out the rescue.
- Provide appropriate First Aid Treatment & Prevent further injury to the casualty.
- Evacuate the casualty to a safe location where suitably qualified persons can administer effective treatment.

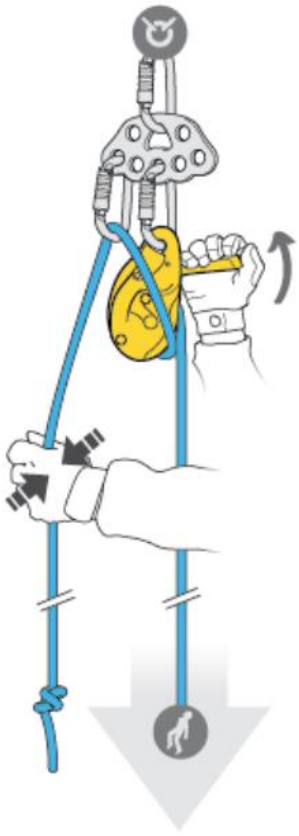
- Casualty management must be constantly addressed throughout the rescue, with the rescuer taking sufficient steps so as not to worsen any injury sustained by the casualty.
- The Level 3 Safety Supervisor should hold a current First Aid certificate appropriate for the location where the work is taking place.

SUSPENSION INTOLERANCE / SUSPENSION TRAUMA

Suspension intolerance is a condition in which a suspended person, e.g. in a harness, can experience certain unpleasant symptoms, which can lead to unconsciousness and eventually death. The reason for this is that the body is not tolerant of being in an upright position and motionless at the same time. Persons likely to be affected are those who are suspended in a generally upright position and who are motionless, for example, when seriously injured or unconscious, or when fastened vertically in a stretcher. For further information on suspension intolerance see Annex G of International Code of Practice.

LOWERING SYSTEMS: IRATA TACS 6.5.2

In many situations where the top anchors are easily accessible and a clear descent can be achieved, rescue can be expedited by rigging the ropes as a releasable lowering system. This will simplify and speed up rescue.



HAULING SYSTEMS: IRATA TACS 6.5.3

Pulley systems are all about the Load on the line versus the effort of Line Pull. These are expressed as a ratio. Typically 2:1, 3:1, 6:1 and 9:1 mechanical advantages (theoretical) and counterweight systems are in operation during the hauling system.

LOAD : LINEPULL

A pulley is basically a wheel on a stick. The pulley wheel is called a sheave and it rotates on an axle. The side plates are called cheeks, depending on the type of pulley, if the cheeks are fixed it is called a fixed cheek pulley, if the cheeks are connected directly to the axle and move separately, it is called a swing cheek pulley.

The rope does not slide against the surface of the sheave, but rotates round with the producing very small amount of friction.

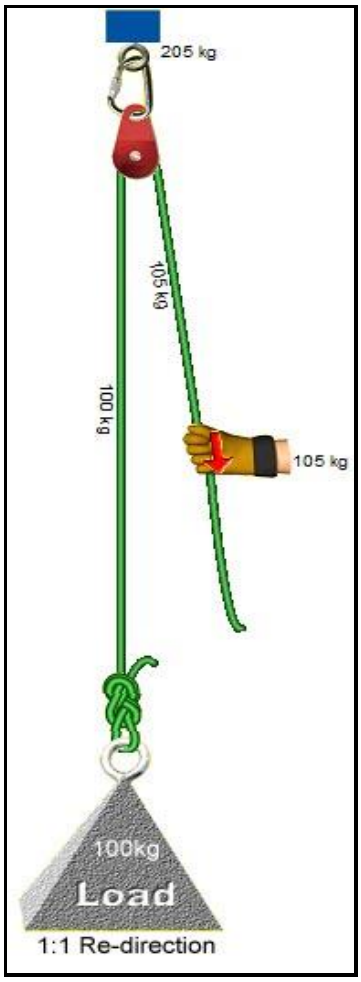
The sheave rotates round the axle, which creates friction. The larger the pulleys sheave the smaller amount of friction created. Some pulleys have roller bearings around the axle, which add approximately 5% friction; a bronze bush will add approximately 40% more friction. By running the rope directly over a karabiner you can create as much as 50% friction thereby in theory doubling the weight of the load.

By using a combination of pulleys, descenders, ascenders and karabiners it is possible to set up hauling and lowering systems, employing the same double rope security, allowing the speedy evacuation of an injured operative from the most difficult of locations.

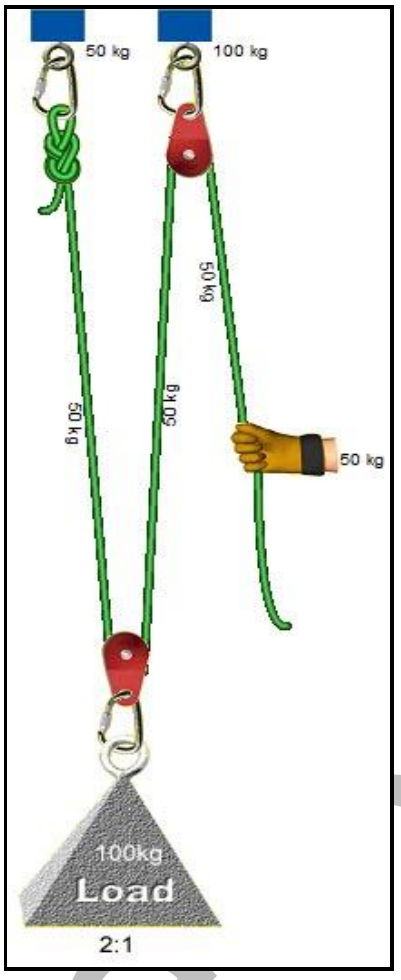
When building pulley systems you should consider the following:

- Use the largest pulleys you can.
- By using a descender to haul with will create higher friction than a non-returnable clutch.
- Hauling over an edge introduces a lot more friction.
- Give yourself plenty headroom, rig as high as you need it.
- Attach to low point on the load, tie knots with small loops, or use a barrel knot.

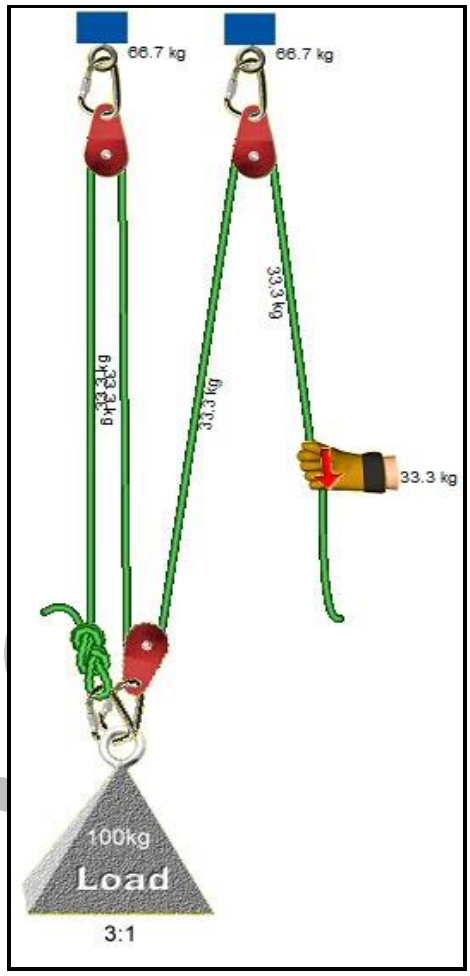
IN THE FOLLOWING DIAGRAMS BACK-UPS NOT SHOWN FOR CLARITY:
EVERYTHING NEEDS TO BE BACKED-UP.



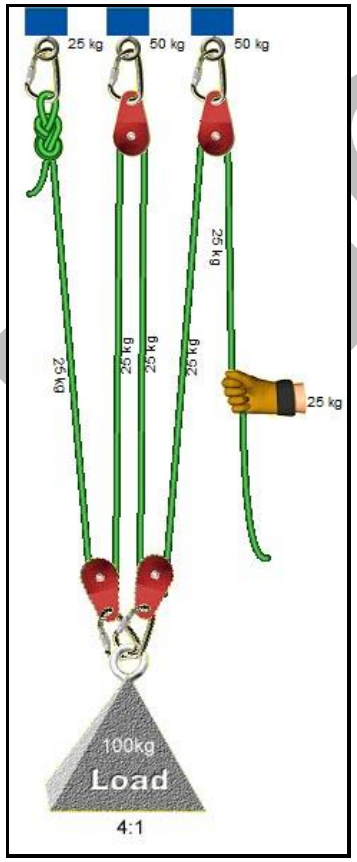
1:1 Re-direction



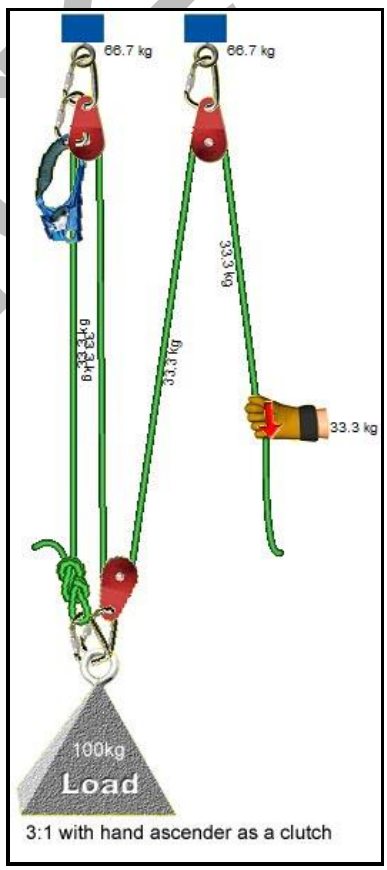
2:1



3:1

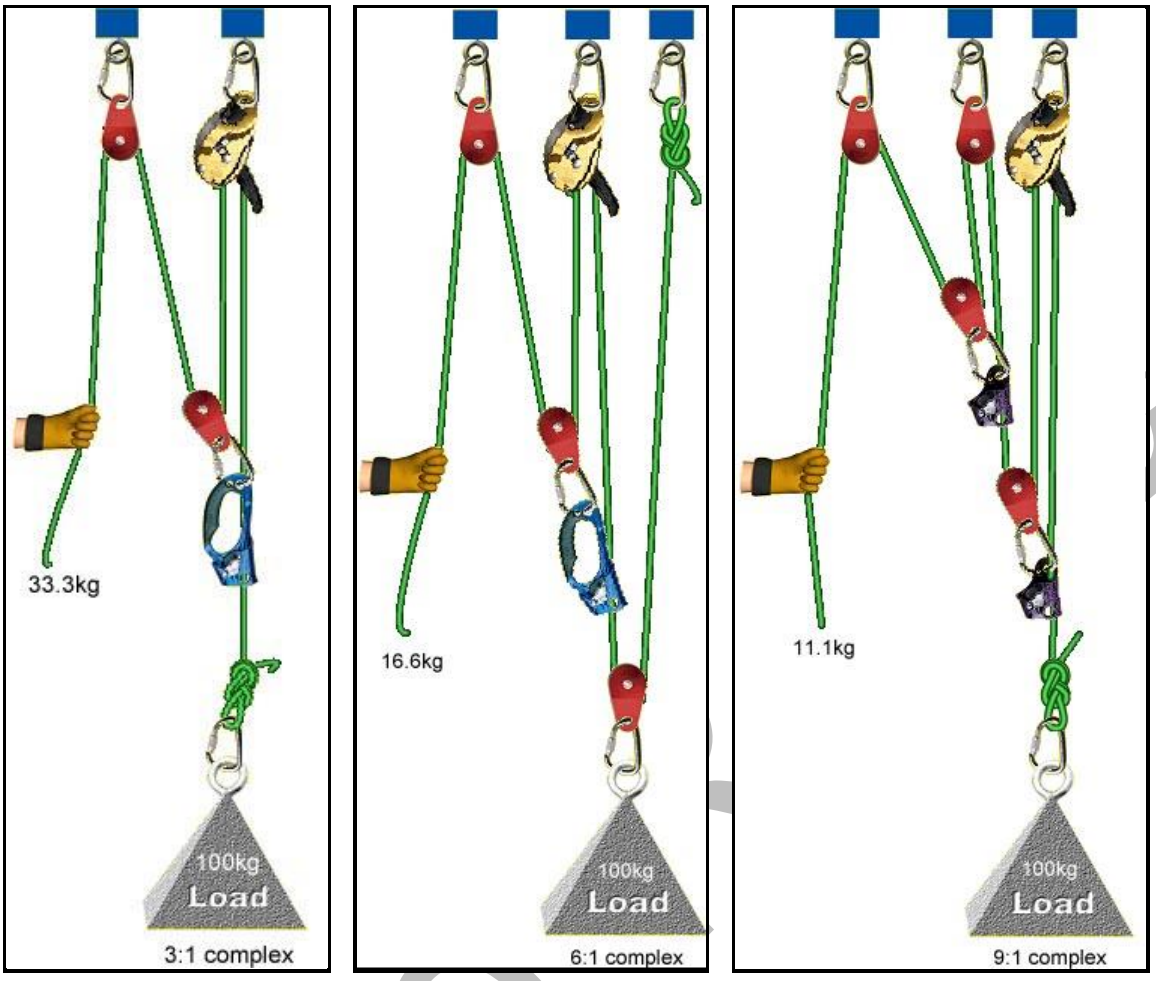


4:1



3:1 with hand ascender as a clutch

By adding a hand ascender to the first pulley creates a non-returnable clutch preventing the rope sliding back down. This is the most efficient type of clutch as it has the least possible friction.



When creating pulley systems we need to take into account of the amount of rope in the system. Lets say we have to haul a load 10m high, if we rig up a 3:1 system directly to the load, we will have 30m of rope in the system to haul upwards to bring the load to the 10m level, plus take into account for rope stretch. In this scenario it would be better to create a 3:1 complex system, thereby using a lot less rope, typically a 12m rope would be sufficient as the ascender can sent down the ropes and breaks into the line. For every 3m of rope taken in the load will move up by 1m.

A 6:1 system can be created by a 2:1 system and adding a 3:1 system upon it. You will need twice as much rope as the 3:1 system as the rope runs from the anchor point down through the load and back to clutch. The advantages of this system is that the load on the anchors is significantly less than what would be if using a 3:1 system, the load is shared between the anchors and so could be used with up to 2 person loads, for example injured casualty and a minder.

A 9:1 system can be created by a 3:1 system adding an additional 3:1 system upon it. For every 9m of rope taken in the load will move up by 1m!

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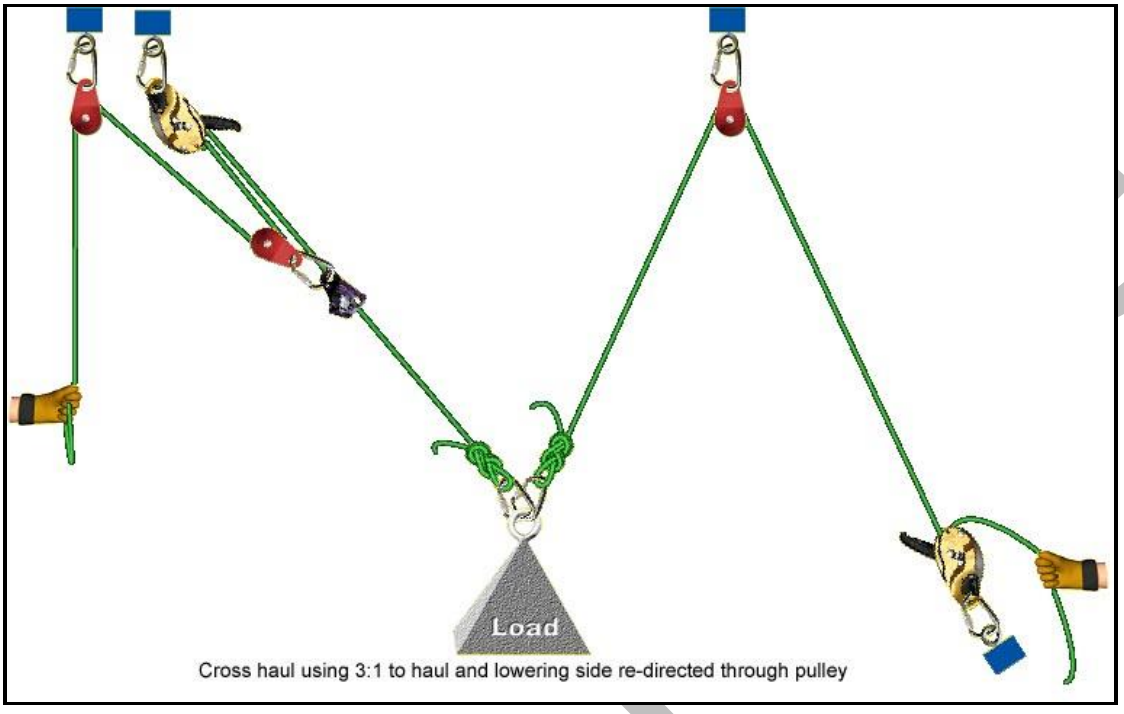
Re-directing the load

By adding a pulley it is possible to re-direct the pulley system to a more comfortable work place. For example instead of hanging in your harness hauling upwards, you could re-direct the load to the ground or work platform where you can be in a better position to haul downwards. It is also possible to control a cross haul from one position by re-directing the ropes. This technique maybe worth considering for rescuing a casualty on an aid climb above water.

Cross Haul: IRATA TACS 6.5.4

Cross hauling is where two or more pulley system are used to move the load, both systems are connected to the load. In practice it is similar to doing a rope transfer. This is another situation where you need to keep an eye on the angle loading.



Cross haul using 3:1 to haul and lowering side re-directed through pulley

Hanging Haul: IRATA TACS 6.5.3

A hanging haul is where the load (typically the casualty) has tension on both ropes and is hanging below. You will need an extra rope to build up a hauling system. Start off by sending an ascender with a karabiner with a barrel knot attached to it down to the load as close to the load as you can. This rope will be your pulley system, build up a 3:1 and haul upwards. Once the load has been lifted slightly it is possible to install a back up onto their back up rope. This is one of the most common rescues; it gets a lot harder when you need to haul over the edge of a building

ROPE MANOEUVRES : IRATA TACS 6.6

Before carrying out any rope access manoeuvres it is recommended that you should warm up and stretch particularly the forearms, you will move better and be less prone to muscular injuries.

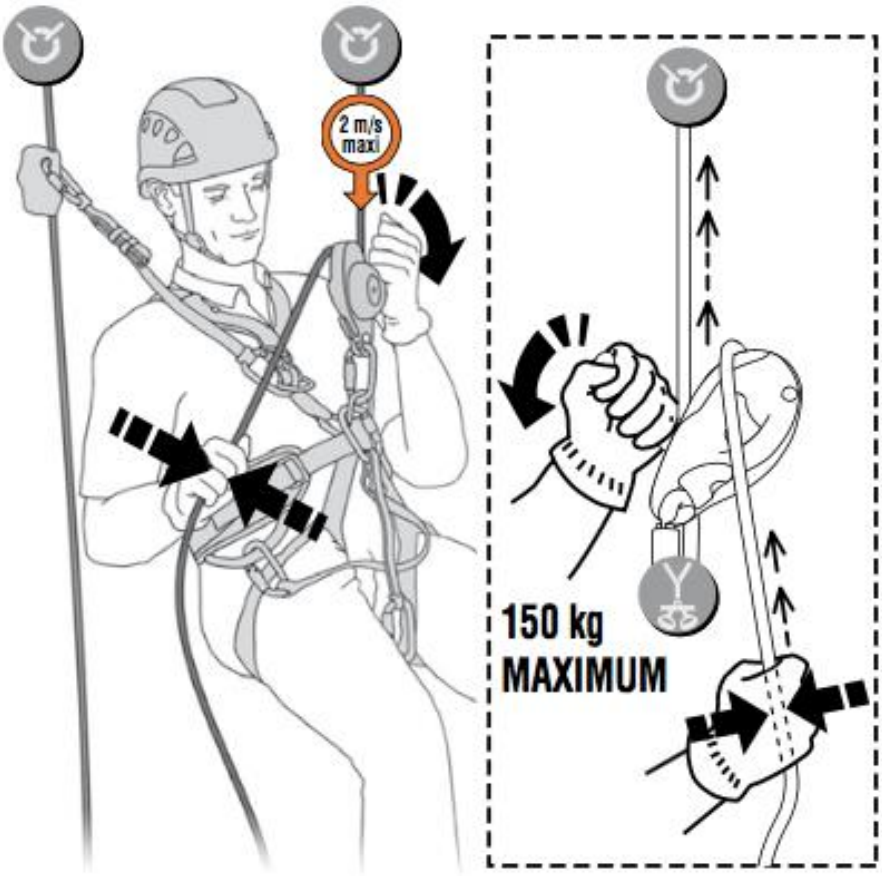
When carrying out rope access manoeuvres, you must have 2 independent points of attachment, 1 point of attachment connected to the working rope and 1 point of attachment connected to the back up/safety rope. Make sure that you secure the gate shut on karabiners when in use.

There are many variations of techniques for the following manoeuvres. The methods outlined below are those that we believe are the easiest way to learn the techniques as a beginner.

Your trainer should individually and carefully demonstrate these manoeuvres exactly as outlined below:

DESCENT: IRATA TACS 6.6.3

- Place Back-up device on back up rope.
- Place descender on working rope and lock-off for security.
- When comfortable on ropes unlock descender.
- Take a good hold of control rope.
- Draw back-up device down by holding small string between index and middle finger.
- Gently squeeze descender handle to descend.
- Allow control rope to pass through hand at a steady rate.
- Keep an eye out below for obstructions and hazards.
- On arrival at worksite lock-off descender and push Back-up device high.



ASCENT: IRATA TACS 6.6.4

(Frog Method)

- Place Back-up device on back up rope.
- Place Croll on working rope.
- Place hand ascender and push high.
- Place working rope between feet in foot loop.
- Remove any slack between feet and Croll and bring feet under your bottom.
- Stand up, provided there is no slack the Croll will travel automatically up the rope.
- Sit back in Croll.
- Repeat.

Ensure Back-up device is kept high at all times.

CHANGEOVERS: IRATA TACS 6.6.5

DESCENT TO ASCENT CHANGEOVER: IRATA TACS 6.6.5

- Place hand ascender on working rope above descender.
- Stand in foot loop and place Croll above descender.
- Remove descender.

ASCENT TO DESCENT CHANGEOVER: IRATA TACS 6.6.5

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- Place descender on working rope below Croll and lock-off.
- Position hand ascender approximately at forehead height - so that it is not going to be out of reach when you sit back in descender .
- Stand in foot loop and bring left arm straight up working rope (this brings chest closer to the rope and is less strenuous on the arm) using right hand remove Croll.
- Sit back in descender.
- Remove hand ascender.
- You may now descend

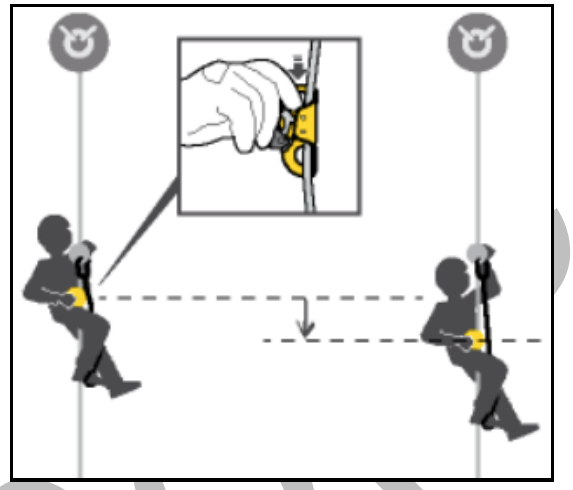
The next 2 manoeuvres are for moving short distances up or down rope.

DESCENT IN ASCENDERS: IRATA TACS 6.6.6

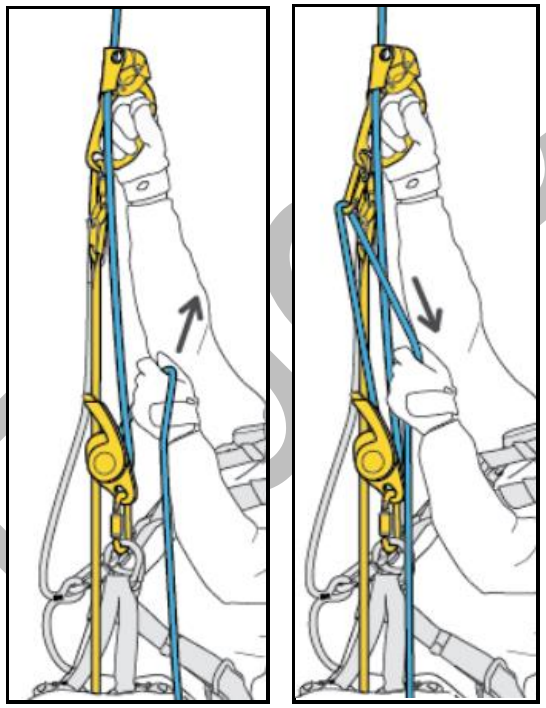
For this manoeuvre you should be ascent mode.

Place working rope either between legs or to left hand side of body

- Position hand ascender approximately at forehead height.
- Stand in foot loop and bring left arm straight up working rope.
- With right forefinger depress top of Croll toothed cam (do not fully open Croll)
- Bend knee and slowly sit back down.
- Draw down back-up device
- Position hand ascender approximately at forehead height.
- Repeat



ASCENT IN DESCENDER: IRATA TACS 6.6.7



For this manoeuvre you will need to be descent mode.

- Place hand ascender above descender and push high
- Hold control rope palm up, as close to the descender and pull upwards at same time stand up slowly whilst maintaining part weight on the descender.
- Try to keep rope from hand ascender to descender under tension as the rope will pull through descender much easier.

DEVIATION: IRATA TACS 6.6.8

Deviations are used either to position the ropes to avoid hazards and obstacles or to position the technician on the worksite. Deviations should not be rigged more than 20° from the vertical. They should be rigged with a big knot below the deviation. Where possible deviations should be rigged in a position on a structure that allows them to be passed easily. A short cow's-tail is useful for passing deviations easily.

Ascent:

- Ascend to deviation.
- Attach short cow's-tail to deviation anchor (a spare karabiner may be rigged to deviation to provide a convenient clip-on point).
- Remove back-up rope from deviation karabiner and push back up device high.
- Remove working rope from deviation karabiner (this requires a degree of co-ordination as your weight is on this rope).
- Sit back in short cow's-tail.
- Put both ropes (the ones below your equipment) back into deviation karabiner.
- Pull on ropes below deviation karabiner until your cow's-tail is slack enough to be unclipped.
- Unclip the cow's-tail and use the ropes in your hand to control yourself into the vertical.

Descent:

- Descend until level with the deviation, lock-off.
- Pull the ropes in until the knot butts against the deviation karabiner.
- Have the short cow's-tail ready; pull yourself across until you can attach the cow's-tail to the deviation.
- Sit back.
- Remove both ropes from the deviation karabiner.
- Pull yourself over and put the working rope in the deviation karabiner above your descender (this requires co-coordinated movement to do smoothly).
- Put your back up rope into the deviation karabiner above your Back-up device, do up karabiner.
- Remove cow's-tail and descend.

ROPE TO ROPE TRANSFERS: IRATA TACS 6.6.9

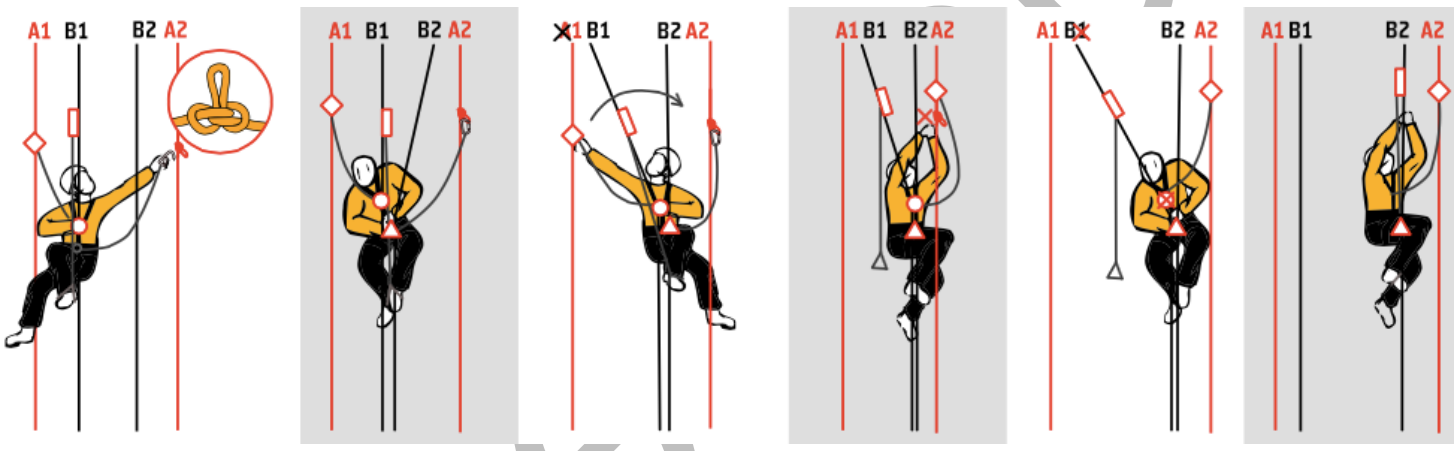
SHORT ROPE TRANSFER: (when the second set of ropes are within reach)

If technician is in ***descender:***

- Place ascenders on new working rope
- Move back-up device to new back up rope
- Release and remove descender from old working rope

If technician is in ***ascenders:***

- Place descender on new working rope
- Take in as much slack as possible on descender and lock-off
- Move Back-up device to new back up rope
- Stand in foot loop and remove Croll
- Reach over and remove hand ascender



LONG ROPE TRANSFER: (allows the technician to traverse large horizontal distances or to achieve precise triangulated positioning in horizontal plane)

(requires a second back up device to prevent pendulum falls in the event of either working rope failing)

- The descender must be positioned on the working rope that the technician is transferring from
- Place ascenders on the new working rope (the one you are transferring to)
- Place second back-up device on new back up rope
- Depending on height restriction either ascend across in direction of new ropes, or simply descend across to position on new set of ropes
- Where precise positioning is important adjustment is made alternately between ascenders and descender until desired position is reached

RE-ANCHOR (ALSO KNOWN AS A RE-BELAY): IRATA TACS 6.6.10

A re-anchor is a secondary set of anchors installed at any distance below the primary anchors. Re-anchors are used to position the ropes to avoid hazards and obstacles such as overhangs or to position the technician on the worksite. The re-anchor should be rigged with sufficient slack in the loop.

For small re-anchor (less than 1.5m apart):

Ascent:

- Ascend to re-anchor, getting as high as possible on ascenders.
- Place descender on rope below Croll (as if you were going back down again, this frees up your ascenders for use in the upper section of the re-anchor).
- Place ascenders onto upper working rope of re-anchor, and put some weight on them.
- Move Back-up device to upper back up rope.
- Release and remove descender.
- Continue up.

Descent:

- Descend level with the re-anchor anchor.
- Place ascenders on to the down ropes.
- Move the Back-up device on to the lower back up rope.
- Release and remove descender from re-anchor rope and replaced on lower working rope.
- Remove ascenders, you are now ready to descend.

For large re-anchor (greater than 1.5m) and LOOP:

The main use of a loop is for travelling beneath suspended structures such as bridges and under deck of oil platforms.

- Ascend to the top of the ropes.
- Make a short rope transfer, Place descender on re-anchor/loop rope.
- Move Back-up device to re-anchor/loop back up rope.
- Place ascenders in front of your descender on re-anchor/loop rope.
- Place a second Back-up device onto the loop back up rope pointing in direction of travel.
- Begin to climb the loop moving sideways on your ascending gear, keeping both back-up devices tight.
- Descend across the re-anchor/loop in much the same way as a long rope transfer.
- When you reach other side of re-anchor/loop, remove your descender and attach to second set of ropes by making a short rope transfer.
- Move trailing back-up device over to down ropes.
- Remove ascenders and second back-up device from re-anchor/loop.
- Descend

PASSING KNOTS: IRATA TACS 6.6.11

Knots may be present in a set of ropes for one of two reasons; either two ropes have been knotted together or a knot has been tied to remove a damaged section from the ropes:

Ascent:

- Ascend to knots.
- Attach spare cow's-tail to knot loop on back up rope, move Back-up device over knot.
- Move cow's-tail to knot loop on working rope.
- **Note: if knot loop contains damaged section of rope then the knot loop cannot be clipped, in which case a temporary knot should be tied to provide back up security as the knot is passed, this can then be removed.*
- Move hand ascender over knot.
- Make sure that you have enough space between knot and hand ascender.
- Stand up and move Croll over knot.
- Remove cow's-tail and continue up rope.

Descent:

- Descend to knots (the knot provides the lock-off for the descender).
- Place hand ascender on working rope above the descender.
- Stand up and place Croll on working rope above the descender.
- The weight is now off the descender.
- Remove descender and replace below knot.
- Pull through slack and lock-off descender.
- Make a move down in ascenders towards knot *(using descent in croll method)*
- Stand up and remove Croll, sit back in descender.
- Remove hand ascender.
- Use spare cow's-tail to move Back-up device down past other knot.

EDGE OBSTRUCTION: IRATA TACS 6.6.12

Where possible, the abseiler will either attach or detach from both safety and working ropes, 2m away from unprotected edges where there is no risk of falling.

If this cannot be achieved, cow's-tails or other suitable equipment must be used to protect the operative whilst in the danger zone between safe ground and the ropes.

Descent

- Place Back-up device on back up rope.
- Open up rope protector.
- Sit down with ropes running down right hand side of body, place descender on working rope at edge.
- Place hand ascender above descender and stand in foot loop and lower yourself over edge until sat in descender.
- Draw Back-up device down.
- Close up rope protector.

Ascent

- Ascend ropes to edge obstruction.
- Open rope protector.
- Push back-up device high over edge.
- Remove hand ascender and place over edge on working rope, ascend higher with Croll and climb over edge.

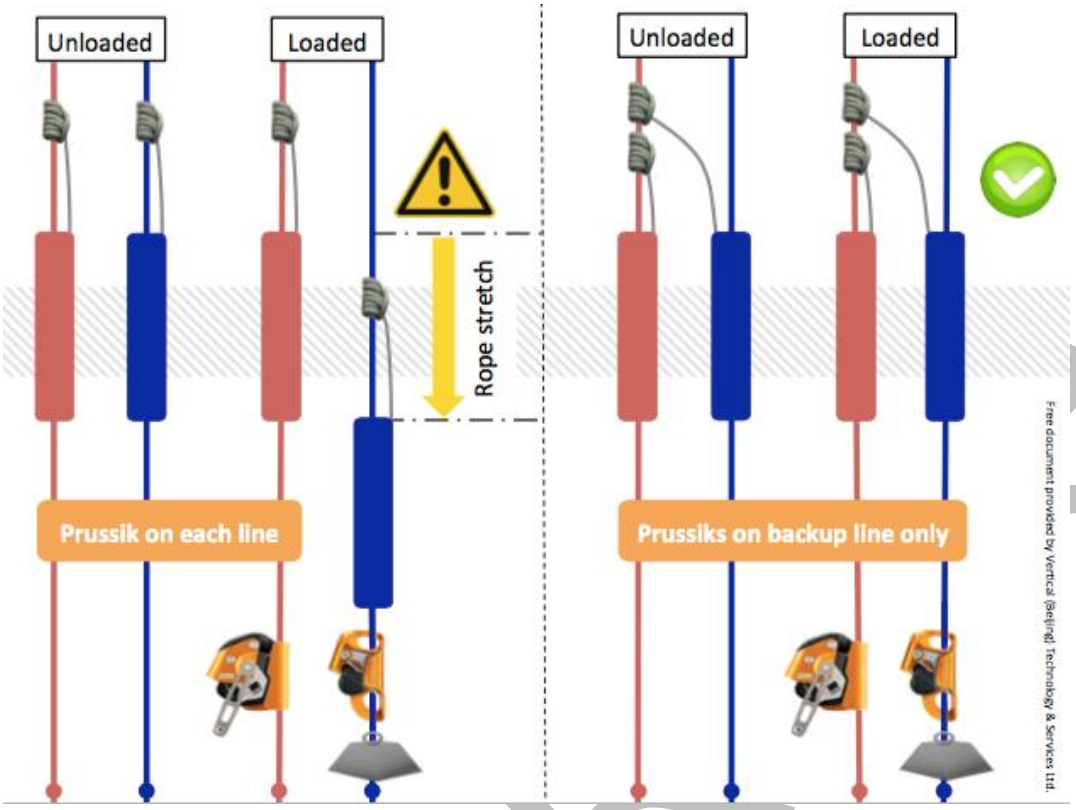
USE OF WORK SEAT: IRATA TACS 6.6.13

These are designed to allow user to sit in comfort when working on ropes. They are not PPE and not part of the fall prevention system. Attach to your harness central 'D' ring, use for descent.

PASSING MID-ROPE PROTECTION: IRATA TACS 6.6.13

Wrap-around canvas rope protectors may be installed mid-rope to protect the ropes against minor abrasive hazards. Commonly attached to the rope by a prussik knots, consideration maybe to use a shunt type of device instead for ease of use.

Descender or ascend to the mid-rope protection, open up protector, it maybe necessary to remove the protector from the rope (don't drop it!) Move past and re-attach mid-rope protection ensuring it will protect the rope from the hazard.



CLIMBING TECHNIQUES: IRATA TACS 6.7

HORIZONTAL AID CLIMBING: IRATA TACS 6.7.2

This technique is used to make horizontal progress whilst suspended from a structure or a series of suitable anchor points. It is important that you are connected to 2 independent anchor points at all times.

- Ascend the ropes stopping just below the aid route
- Remove hand ascender cow's-tail and attach it directly to the rope anchor point karabiner.
- Attach spare cow's-tail into first free anchor point karabiner, (a descender may be put on at this point if you wish) stand up and remove Croll from working rope and place onto spare cow's-tail, pull through any slack, sit back. (Floating / short cow's-tail).
- Remove the hand ascender and attach its cow's tail to the next free anchor point karabiner. (Leading cow's-tail). You will now be attached to 2 separate anchor points with your cow's-tails.
- Remove back-up device device and attach its cow's-tail to the first free anchor point karabiner (same anchor point as spare cow's tail with Croll on it). Attach an etrier to this cow's-tail. (Trailing cow's-tail).
- Stand in the foot loop and etrier, remove the floating / short cow's-tail with Croll and attach to the same anchor point Karabiner as the leading cow's-tail.
- Remove the leading cow's-tail and move it forward to the next free anchor point karabiner.
- Remove the trailing cow's-tail and re-attached to the floating / short cow's-tail anchor point karabiner.
- Stand in the foot loop and etrier and remove the floating / short cow's-tail, re-attaching it to the leading cow's-tail anchor point karabiner.
- Repeating the procedure; systematically moving the cow's-tails in the direction of travel, removing and then relocating each cow's-tail in turn will allow you to make forward progress.
- Aim to be suspended from the short/floating cow's tail at all times unless involved in the process of moving it. This ensures that you remain close to the structure and that other cow's-tails can be relocated freely whilst not being placed under any load.

VERTICAL AID CLIMBING: IRATA TACS 6.7.3

This technique is used to make vertical progress whilst suspended from a structure or a series of suitable anchor points.

It is important to ensure that should an anchor point fail the operative's fall height is reduced to as short a distance as is reasonably practicable.

Recommend using single "I" fall arrest lanyard on the lower anchor point instead of a cow's-tail.

The following routine gives the example of ascending a vertical aid route from ground level.

- Attach a single fall arrest lanyard to the first anchor point, and attach etrier to lanyard karabiner.
- Stand in the etrier and attach a cow's-tail with Croll connected (short/floating cow's-tail) to the same anchor point karabiner.
- Attach a long cow's-tail to the next attachment point karabiner and attach to the cow's tail karabiner a foot etrier. (Leading cow's-tail).
- Stand in the upper foot loop or etrier, remove the short cow's-tail and re-attach to the upper anchor point karabiner.
- Repeating the procedure, systematically moving the leading cow's-tails in the direction of travel, removing and then relocating each other cow's-tail in turn will allow you to make upward progress in much the same way as if progressing horizontally. Always keep fall arrest lanyard on lower anchor point.
- Aim to be suspended from the short/floating cow's-tail at all times unless involved in the process of moving it. This ensures that you remain close to the structure and that other cow's-tails/lanyards can be relocated freely whilst not being placed under any load.

It is possible to make horizontal progress sliding along a structure by utilising three wire or webbing slings:

- Attach the leading and trailing cow's-tails to the two outside slings and attach the short cow's-tail to the central sling.
- De-weight the central sling by standing in the foot loop and/or etrier and move this sling in the direction of travel.
- Re-weight the central sling and move the leading and trailing slings in the same direction.
- Repeat this process until a junction is encountered. Pass the obstruction by removing one sling at a time whilst maintaining two independent attachments.

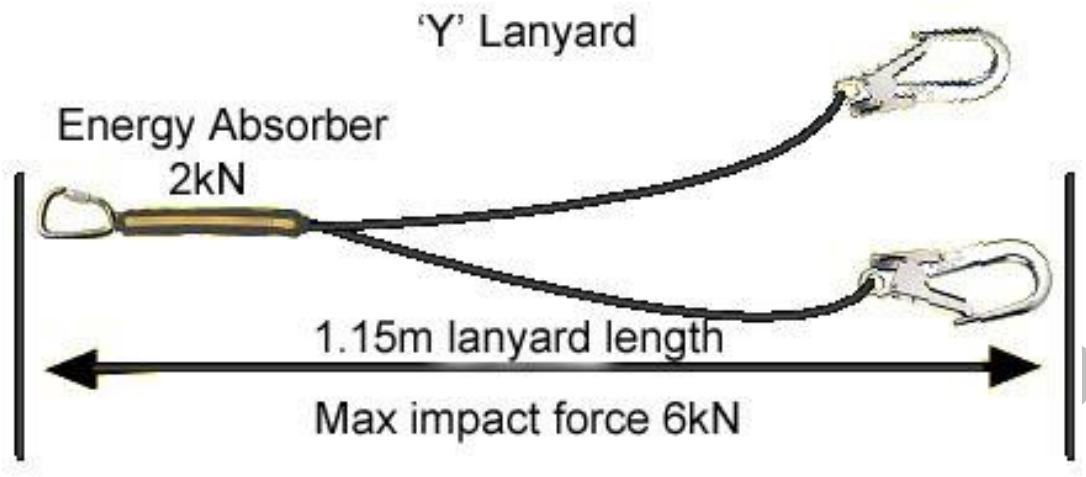
CLIMBING WITH FALL ARREST LANYARDS: IRATA TACS 6.7.4

Fall arrest climbing is a technique, which makes use of PPE to stop a falling person under safe conditions, should the user lose physical contact with the work structure there will be a free fall.

During the fall the user and their protection should not experience any force in excess of 6kN (approx 600kg). 6 kN is a recognized threshold of injury.

A suitable full body harness EN 361 with sternal or dorsal attachment point is used in combination with an energy-absorbing lanyard EN 355. After a fall, the user must be retained in an upright person; this is the reason for having high attachment point. It is best to adjust harness close and not loose fitting.

When climbing the structure, hands and feet are the primary point of contact and the fall arrest lanyard is the secondary point (back up/safety).



The maximum length of a lanyard is 2m; in the training centre we use the above lanyards that are shorter length at 1.15m.

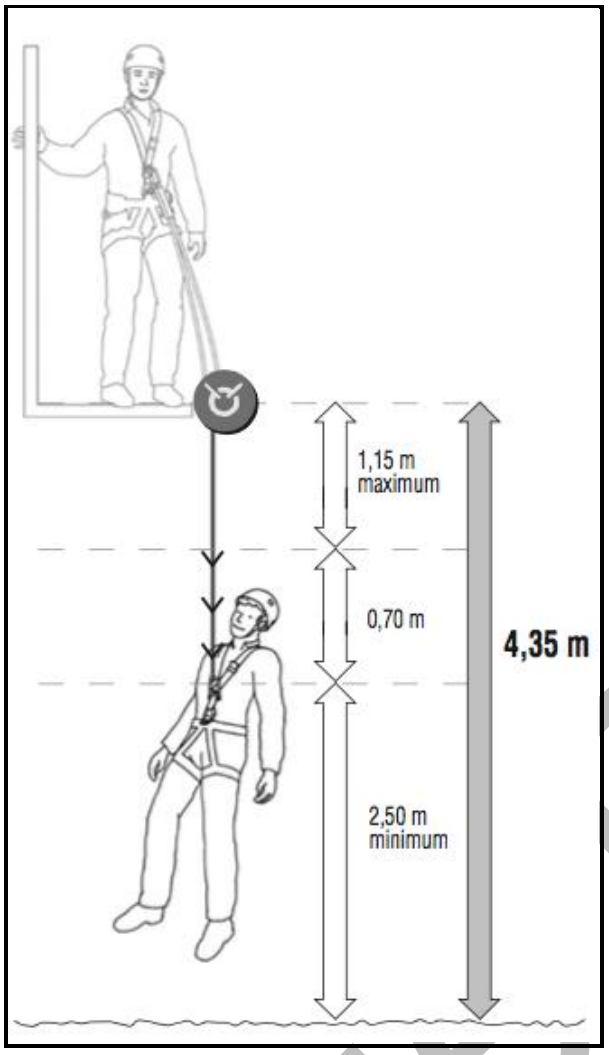
The energy absorber will deploy after 2kN of force has been subjected upon it. On a 2m lanyard the energy absorber will extend by up to 1.75m in length, the lanyard above will extend by 0.70m.

When using a Y lanyard, **NEVER** clip one of the lanyard tails back to a hard point on your harness, because if you were to fall, this would bypass the energy absorber and offer minimal energy absorption.

NEVER add an extra length to a fall arrest lanyard, as this will increase the fall distance without adding energy absorption, which in the event of a fall, could exceed the 6kN maximum allowed in EN 355, as well as greater chance of hitting something.

NEVER climb above anchor slings as this will effectively increases the length of the fall arrest lanyard as above, without adding energy absorption, and in the event of a fall could exceed the 6kN maximum allowed in EN 355.

NEVER use two single energy-absorbing lanyards. In the event of a fall onto both lanyards the maximum peak impact force applied to the body would be double the force that would be applied if a single energy absorber were used.



The clearance distance is the amount of free fall space between the anchor and an obstacle or the ground and should be sufficient to prevent the user hitting anything. Manufacturer's information will give the clearance distance for the product; it is made up of:

* Fall distance - possibly from above the anchor e.g. fall factor

* Energy absorbing lanyard

* Energy absorber extension

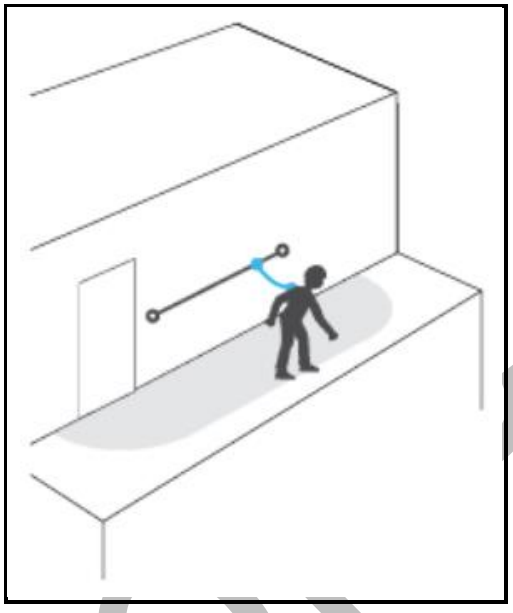
* Distance from the worker's harness attachment to worker's feet

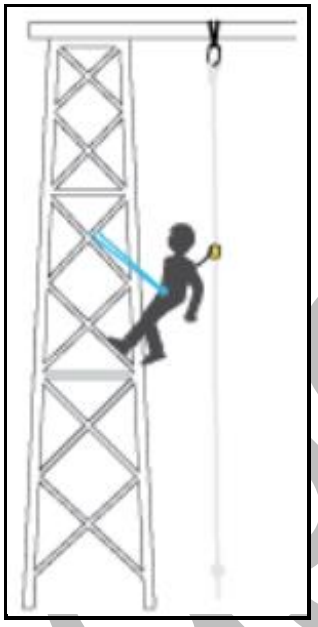
* Distance below worker's feet – to prevent impact with ground or structure.

The length of the fall must always be minimised by attaching the lanyard as high as possible, preferably above head height [see fall factors], especially when working lower than the manufacturer's stated clearance distance. A minimal fall will cause minimal deployment of the energy absorber, reducing the likelihood of impact with a structure and force related injury.

DEFINITIONS

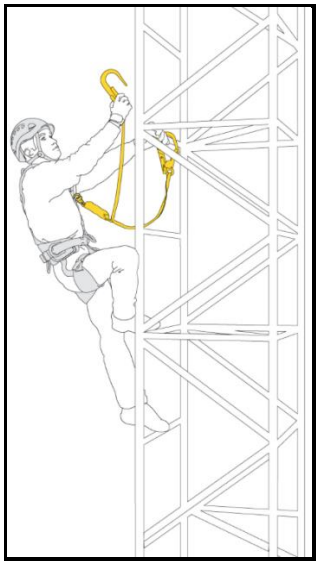
Work restraint is a technique, which makes use of items of PPE to prevent a person from entering an area where a risk of a fall from height exists.





Work position is a technique for supporting a person whilst working, by means of PPE in tension, in such a way as to prevent a fall. Rope access and aid climbing are examples of this technique.

Fall Arrest is a system utilizing PPE intended to stop a falling person from hitting the ground or obstructions. The PPE is designed to limit the impact force of the fall and retain the user upright in the harness.



Fall Factors

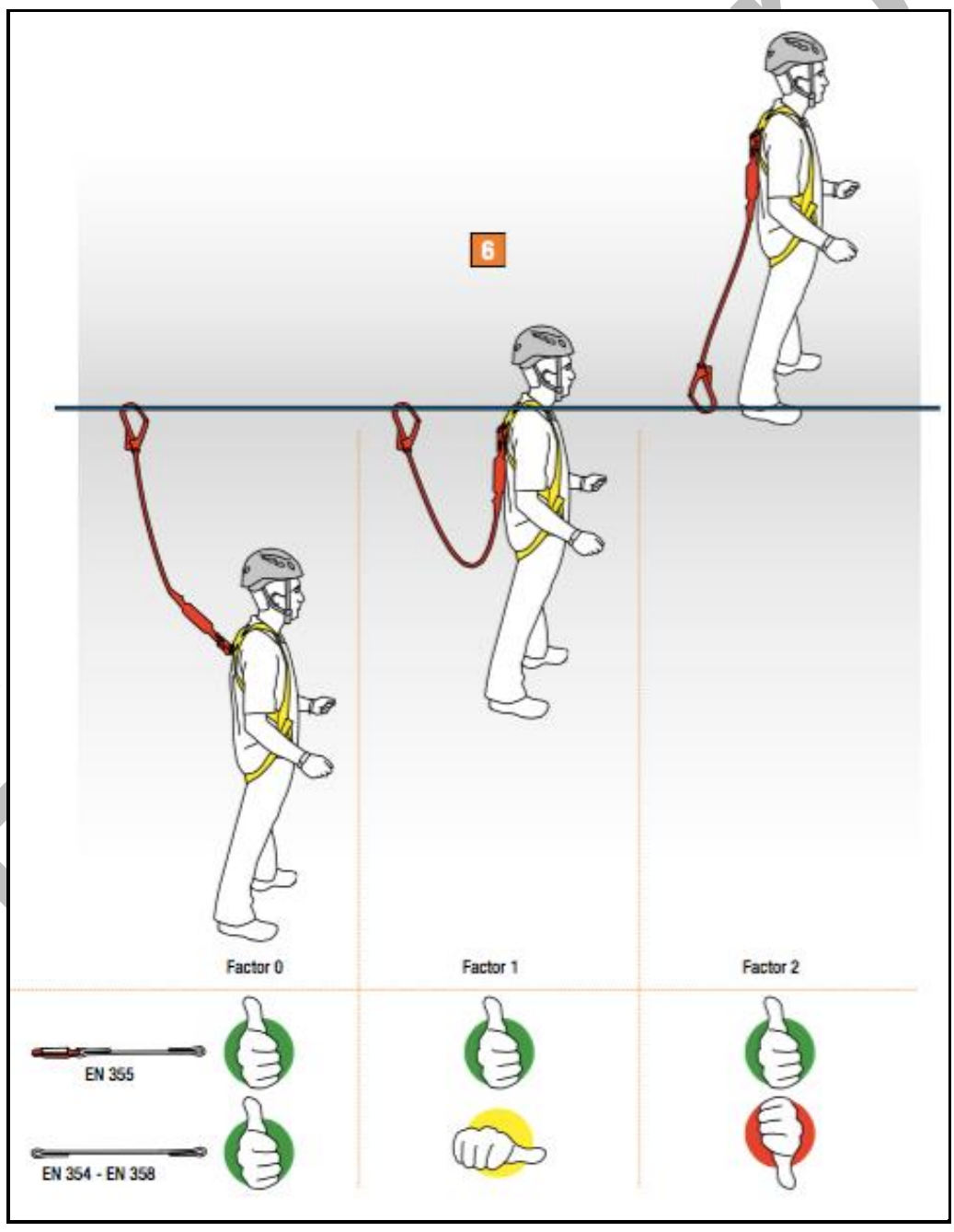
Fall Factors measure the relative severity of a fall in terms of the shock loads placed upon the equipment and user.

The Fall Factor is calculated by dividing the length of fall by the length of rope holding the fall:

FALL FACTOR (FF) = LENGTH OF FALL
LENGTH OF ROPE

It is important to ensure that the Fall Factor (FF) is kept to a minimum. Whilst Dynamic rope is capable of withstanding a Fall Factor 2 fall when new it is good practice not to exceed FF1, and likewise it is good practice not to exceed FF 0.3 with a Low Stretch rope.

Attachment to vertical or diagonal members can be potentially dangerous as this could result in a sliding fall with a fall factor greater than FF2.



RESCUES AND HAULING: IRATA TACS 6.5 & 6.9

Under the Work at Height Regulations 2005, a rescue plan should be in place for recovering any team member that becomes incapacitated whilst working at height and should be identified at the 'Risk Assessment' stage, before any work commences and should be fully described in the 'Method Statement'.

In any rescue the main principals are to always have a back-up, have the correct equipment to carry out the rescue and ensure that all rescue team members fully understand the techniques involved.

If the rescue scenario is particularly complicated then a practice rescue should be carried out to ensure the proposed rescue method could be successfully completed within an acceptable time span. Consider rigging for rescue, is it possible to lower the casualty to safety, or is a haul system in place to recover the casualty. Basically the ropes you rig on site are ropes you have to rescue from. Keep potential rescues as simple as possible, starting with the rigging.

A rescue and recovery kit should accompany all rope access teams. This will include sufficient equipment to rescue a technician from any of the rope access situations in which they may be operating. Dedicated rescue equipment should not be used for anything other than a rescue.

Before commencing any rescue it is important that the cause of the casualty's accident is fully understood, so that these conditions do not effect the rescue team, for example if the casualty is unconscious through gassing.

Consider the position of casualty vs. the rescuer, in some scenarios it would be better casualty management for the rescuer to be beneath the casualty as this allows the rescuer to walk or push away from the structure with their legs.

- Ensure the rescuers do not endanger themselves whilst carrying out the rescue.
- Provide appropriate First Aid Treatment & Prevent further injury to the casualty.
- Evacuate the casualty to a safe location where suitably qualified persons can administer effective treatment.
- Casualty management must be constantly addressed throughout the rescue, with the rescuer taking sufficient steps so as not to worsen any injury sustained by the casualty.
- The Level 3 Safety Supervisor should hold a current First Aid certificate appropriate for the location where the work is taking place.

SUSPENSION INTOLERANCE / SUSPENSION TRAUMA

Suspension intolerance is a condition in which a suspended person, e.g. in a harness, can experience certain unpleasant symptoms, which can lead to unconsciousness and eventually death. The reason for this is that the body is not tolerant of being in an upright position and motionless at the same time. Persons likely to be affected are those who are suspended in a generally upright position and who are motionless, for example, when seriously injured or unconscious, or when fastened vertically in a stretcher. For further information on suspension intolerance see **Annex G of International Code of Practice**.

“Pick-off” / “Snatch”, Rescue of casualty who is in descent mode: IRATA TACS 6.8.2

Most rope access work is carried out while in descent mode; therefore, all rope access technicians should be capable of carrying out a rescue of a co-worker suspended by a descending device.

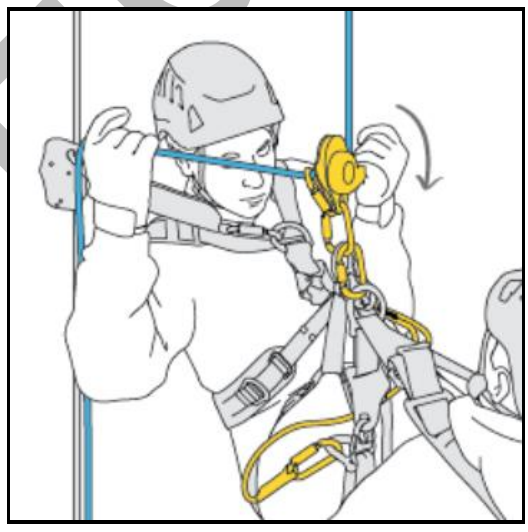
This technique allows an unconscious casualty hanging in their descender to be brought down by the rescuer. Two techniques are described, with and without an extra set of ropes for the rescuer.

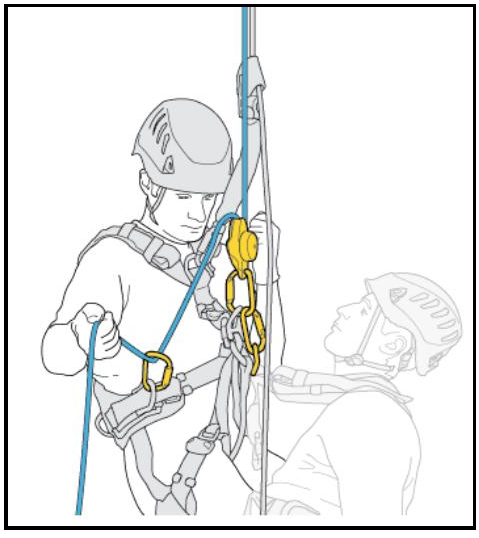
Method 1 - Rescuer on separate set of ropes

- Rescuer descends/ascends level with casualty *(in either event he must get into descender).*
- Rescuer attaches short cow’s-tail to casualty’s harness central ‘D’ ring.
- Rescuer attaches short connection between rescuers descender karabiner and casualty’s central ‘D’ ring (the casualty now has two independent attachments to the rescuer).
- Rescuer releases and removes the casualty’s descender.
- Rescuer then removes the casualty’s back-up device.
- Casualty should be sat upright with a karabiner from chest harness.
- Rescuer places control rope through an extra karabiner below descender on harness; this provides extra friction, and therefore control, to deal with the added weight of the casualty.
- Rescuer descends to ground with casualty, keeping the back-up device high and carefully lands casualty.

Method 2 - Rescuer on same set of ropes (rescue from below)

- Rescuer ascends BACK-UP rope until level with casualty.
- Rescuer changes into descender.
- Rescuer attaches back up cow’s-tail to casualty’s harness.
- Rescuer moves back-up device above casualty’s descender.
- Rescuer then removes the casualty’s back-up device.
- Rescuer attaches short connection between rescuer’s descender karabiner and casualty’s sternal ‘D’ ring (the casualty now has two independent attachments to the rescuer).
- Rescuer releases and removes the casualty’s descender.
- Rescuer places control rope through an extra karabiner below descender on harness; this provides extra friction, and therefore control, to deal with the added weight of the casualty.
- Rescuer descends to ground with casualty, keeping the back-up device high and carefully lands casualty.





“Pick-off” / “Snatch”, Rescue of a casualty who is in ascent mode: **IRATA TACS 6.8.3**

This technique allows an unconscious casualty hanging in their ascenders to be brought down by the rescuer. The main complication in this exercise is that the rescuer has to raise the casualty’s weight to remove their Croll.

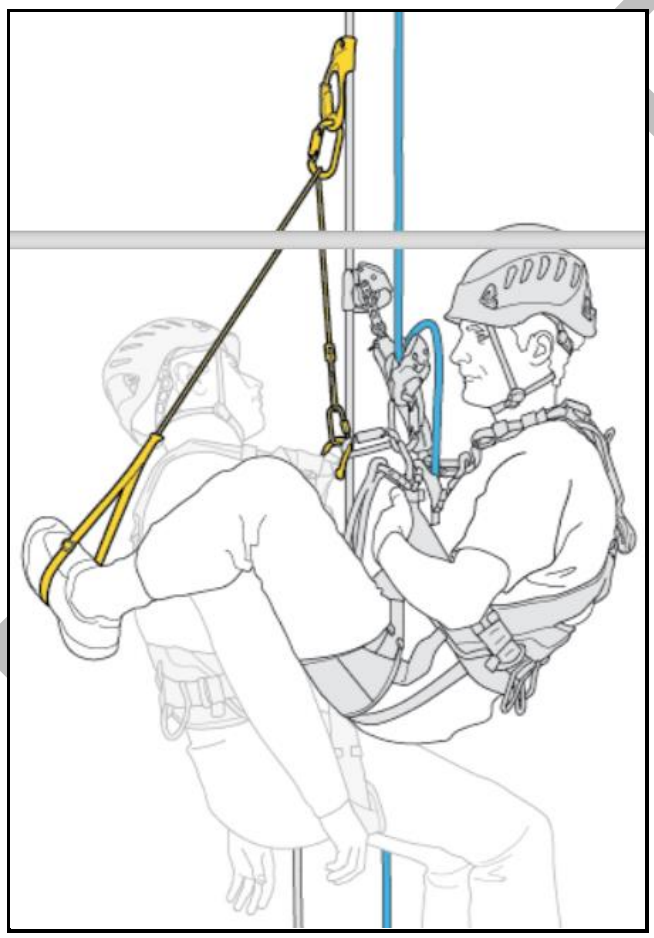
Method 1 - Raising casualty through Descender, this method is probably the most time consuming, it is however the most foolproof

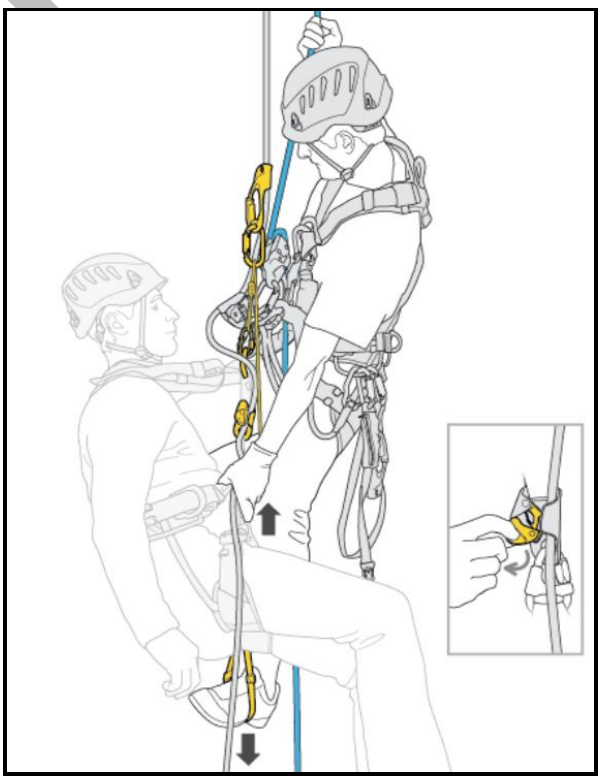
- Rescuer ascends casualty’s BACK-UP rope until level with the casualty.
- Casualty should be assessed.
- Rescuer changes into descender.
- Rescuer attaches back up cow’s-tail to casualty’s harness.
- Rescuer moves his Back-up device above casualty’s ascenders.
- Rescuer then removes the casualty’s back-up device
- Rescuer attaches short connection between rescuers descender karabiner and casualty’s central ‘D’ ring (the casualty now has two independent attachments to the rescuer).
- The rescuer takes the casualty’s hand ascender (minus cow’s-tail and foot loop) and places it on his working rope above their descender.
- A pulley is attached to the hand ascender.
- The control rope from the descender is run through the pulley.
- The rescuer places his hand ascender on the rope emerging from the pulley (it is usually a good idea to shorten the foot loop by clipping it back to itself).
- Rescuer unlocks descender and starts to raise the casualty by standing in his foot loop.
- As the rescuer stands the rope is pulled through the descender, both rescuer and casualty ascend.
- The rescuer keeps checking the casualty’s Croll by sitting him upright.
- When possible the Croll is removed and the casualty is clipped upright through his chest harness.
- Rescuer locks-off descender and removes pulley/hand ascender from above.
- Control rope is installed in friction karabiner.
- Rescuer descends to ground with casualty and carefully lands them.

**Note: This descender/hand ascender/pulley assembly can be used to ascend the entire rope with a casualty - strenuous!*

Method 2 - Counterbalance, this requires some co-ordination but is often the easiest.

- Rescuer ascends casualty's BACK-UP rope until level with the casualty.
- Casualty should be assessed.
- Rescuer changes into descender.
- Rescuer attaches back up cow's-tail to casualty's harness.
- Rescuer moves his Back-up device above casualty's ascenders.
- Rescuer then removes the casualty's back-up device
- Rescuer attaches short connection between rescuer's descender karabiner and casualty's sternal 'D' ring (the casualty now has two independent attachments to the rescuer).
- The rescuer takes the casualty's hand ascender (minus cow's-tail and foot loop) and places it on his working rope above their descender.
- Rescuer uses either a sling, foot loop, or loop of paracord (approx 120cm in length). This should be attached to casualty's sternal 'D' Ring and run up through a karabiner on casualty's hand ascender.
- Rescuer stands in sling/foot loop with straight leg with their weight over standing foot.
- Rescuer lifts casualty's waist belt with hand, the casualty has moved upwards.
- Rescuer removes rope from Croll and lowers casualty weight on to rescuer.
- Casualty should be sat upright with a karabiner from chest harness.
- Rescuer places control rope through an extra karabiner below descender on harness; this provides extra friction, and therefore control, to deal with the added weight of the casualty.
- Rescuer descends to ground with casualty, keeping the back-up device high and carefully lands casualty.





The following rescues use a combination of the "Pick-off" / "Snatch" rescue techniques and hauling and lowering techniques.

Passing a deviation with a casualty: IRATA TACS 6.8.4

For passing a small or single deviation:

- Rescuer performs a "Pick-off" / "Snatch" rescue.
- Rescuer descends to eye level height of deviation anchor. Rescuer locks off descender.
- Rescuer removes casualty's descender and attaches to rescuers 'D' ring.
- Rescuer attaches tail end of rope into deviation anchor and connects rope into casualty's descender.
- Create a pulley system using this rope to pull you in enough for deviation sling to become slack.
- Remove both ropes from the deviation karabiner.
- Replace deviation sling above descender and back up device.
- Remove pulley system from deviation anchor.
- Rescuer descends to ground with casualty, keeping the back-up device high and carefully lands casualty.

For passing a large or double deviation:

- Rescuer performs a "Pick-off" / "Snatch" rescue.
- Rescuer descends to eye level height of deviation anchor. Rescuer locks off descender.
- Rescuer removes casualty's descender and attaches to rescuers 'D' ring.
- Rescuer reaches over for back up rope below the deviation karabiner and attaches rope to descender and takes in as much slack and locks off.
- Rescuer descends on first descender until both descenders are loaded equally.
- Rescuer removes back-up device from back up rope and connects to working rope above first descender.
- Rescuer continues to descend until first descender can be removed. Rescuer is now loaded on second descender.
- The back-up device will be above the deviation karabiner. Using spare back-up device connect below deviation karabiner.
- Rescuer places control rope through an extra karabiner below descender on harness.
- Rescuer descends to ground with casualty, keeping the back-up device high and carefully lands casualty.

Rope-to-rope transfer with a casualty: IRATA TACS 6.8.5

- Rescuer performs a "Pick-off" / "Snatch" rescue.
- Rescuer removes casualty's descender and attaches to rescuers 'D' ring.
- Rescuer reaches over for second set of ropes and attaches rope to descender and takes in slack and locks off.
- Rescuer attaches second back-up device on to second set of ropes.
- If rescuer needs to maintain height on the second set of ropes, the descender/hand ascender/pulley technique as described above can ascend across the ropes.
- Rescuer descends from first set of ropes until all weight is on second set of ropes.

Passing a small re-anchor with a casualty: **IRATA TACS 6.8.6**

- Rescuer performs a “Pick-off” / “Snatch” rescue.
- Rescuer descends to eye level height of re-anchor anchors. Don’t go too low. Rescuer locks off descender.
- Rescuer removes casualty’s descender and attaches to rescuers ‘D’ ring.
- Rescuer reaches over for second set of ropes and attaches rope to descender and takes in as much slack and locks off.
- Rescuer descends on first descender until both descenders are loaded equally.
- Rescuer removes back-up device from re-anchor and connects to back up rope of second set of ropes.
- Rescuer continues to descend from re-anchor until descender can be removed.
- Rescuer places control rope through an extra karabiner below descender on harness.
- Rescuer descends to ground with casualty, keeping the back-up device high and carefully lands casualty.

Mid-transfer rescue: **IRATA TACS 6.8.7**

Easy way is to approach the casualty from the ascending side.

- Using an adjacent set of ropes next to re-anchor/rope transfer, ascend to the top of ropes and change into descent mode.
- Rescuer attaches karabiner from ‘D’ ring onto re-anchor ropes.
- Rescuer descends using re-anchor as tensioned rope to casualty.
- Rescuer removes casualty’s hand ascender and gets as close to the casualty as possible.
- Rescuer attaches short cow’s-tail to casualty’s central ‘D’ ring.
- Rescuer attaches short connection between rescuers descender karabiner and casualty’s central ‘D’ ring.
- Rescuer takes the casualty’s hand ascender (minus cow’s-tail and foot loop) and places it on their working rope above their descender. Add pulley to the hand ascender.
- The control rope from the descender is run through the pulley.
- Rescuer places his hand ascender on the rope emerging from the pulley (shorten the foot loop by clipping it back to itself).
- Rescuer raises the casualty by standing in his foot loop.
- As the rescuer stands the rope is pulled through the descender, both rescuer and casualty ascend.
- Rescuer removes casualty’s Croll and clips upright through his chest harness using a karabiner. Rescue can remove their karabiner the loop rope to their ‘D’ ring.
- Rescue unlocks casualty’s descender and lowers across the re-anchor/rope transfer.
- You may need to climb the rope through your descender until the casualty’s descender has become loose.
- Once off the loop, rescuer places control rope through an extra karabiner below descender on harness for added friction.
- Rescuer descends to ground with casualty, keeping the back-up device high and carefully lands casualty.

It is possible to rescue from the casualty’s descender side, this requires the rescuer to carry out a changeover of the casualty’s croll to descender first before carrying out rescue.

Passing mid-rope knots with a casualty: IRATA TACS 6.8.8

This rescue will depend on the position of the knots and the position of the casualty.
If the knots are offset, the rescue should be reasonably straightforward. If the rescue is on long ropes and the knots are equal height, there is a good chance that the rope stretch of the rescuer ascending the back up rope will be enough to offset the knots.

If the knots are of equal height:

- Rescuer performs a “Pick-off” / “Snatch” rescue.
- Rescuer ties an Alpine Butterfly with about 30cm loop on back up rope below back-up device. The knots below will be offset.
- Rescuer descends to level height of knot in back up rope. Rescuer locks off descender.
- Rescuer removes casualty’s descender and attaches to rescuers ‘D’ ring.
- Rescuer attaches casualty’s descender to back up rope below knot and locks off.
- Rescuer descends on first descender until both descenders are loaded equally.
- Rescuer removes back-up device from back up rope and connects to working rope above first descender.
- Rescuer continues to descend until first descender can be removed. Rescuer is now loaded on second descender.
- Rescuer descends to second knot and moves back-up device past.
- Rescuer descends to ground with casualty, keeping the back-up device high and carefully lands casualty.

Alternatively if the casualty is sat directly above the knots:

Create a re-anchor above the knot to provide a clean rope to the ground:

- Rescuer ascends back up rope and passes knot.
- Rescuer creates a re-anchor above the rescuer’s Croll using a hand ascender. *This provide a clean rope free of knots to the ground.*
- Rescuer changes into descender on clean rope.
- Rescuer performs a “Pick-off” / “Snatch” rescue.
- Rescuer descends to ground with casualty, keeping the back-up device high and carefully lands casualty.

Another option is to control the casualty’s equipment for them and descend their Croll towards the knot as you would for passing a set of knots normally. As the casualty gets to knot, the rescuer can connect to casualty and perform a **“Pick-off” / “Snatch”** rescue.

CLIMBING RESCUES: IRATA TACS 6.9

Rescue from an aid climb: IRATA TACS 6.9.1

There are two main ways at tackling this rescue. In both scenarios a rescue kit will be required. Approach the casualty as soon as possible without compromising your safety.

Method 1 - "Pick-off" / "Snatch" rescue onto set of ropes; this is the preferred method as the rescuer is constantly monitoring the casualty.

- Rescuer rigs a set of ropes as close to the casualty as possible. Make sure the ropes are rigged as high as possible, to give yourself enough headroom.
- Rescuer attaches descender and back-up device on to ropes.
- Rescuer attaches back up cow's-tail to casualty's central 'D' ring.
- Rescuer attaches short connection between rescuers descender karabiner and casualty's central 'D' ring (the casualty now has two independent attachments to the rescuer).
- Rescuer using counterbalance **"Pick-off" / "Snatch"** rescue technique removes casualty's Croll and cow's-tails. Casualty should be sat upright with a karabiner from chest harness.
- Rescuer places control rope through an extra karabiner below descender on harness; this provides extra friction, and therefore control, to deal with the added weight of the casualty.
- Rescuer descends to ground with casualty, keeping the back-up device high and carefully lands casualty.

Method 2 - Set up a lowering system

- Rescuer rigs a 2:1 haul system and attaches haul system rope and back up rope to casualty's central 'D' ring. (The casualty now has two independent attachments).
- Rescuer lifts casualty on haul system so that the casualty's weight is off cow's-tails.
- Rescuer removes casualty's Croll and cow's-tails. Casualty should be sat upright with a karabiner from chest harness.
- Rescuer lowers casualty to ground.

Rescue from fall arrest equipment: IRATA TACS 6.9.2

- Rescuer climbs out to casualty.
- Rescuer sets up a set of ropes and gets on them in decent mode.
- Rescuer attaches cow's-tail and short link to casualty.
- Rescuer creates a mini pulley system to take casualty's weight and remove fall arrest lanyards.
- Rescuer descends to ground.

Rescue from an aid climb with the casualty on a short connection: IRATA TACS 6.9.3

A short link is where the casualty has connected from there central 'D' ring with a karabiner directly to an eyebolt or other hard anchor point. There are anchors points above to rig from. This is hard aid climb rescue and a position you should not let others get into. Approach the casualty as soon as possible without compromising your safety.

Method 1 - lower casualty:

- Rescuer connects barrel knots in tails of ropes and connects to casualty's 'D' ring.
- Rescuer sets up descender as close to casualty as possible *(sometimes you can set this up on the anchor attachment the short-link is connected to)* and attaches rope from casualty into descender.
- Rescuer sets up back rope from casualty on separate anchor attachment.
- Rescuer attaches counterbalance sling directly into harness webbing and feeds sling through eyebolt and unscrew the short link karabiner.
- Perform a counterbalance rescue; remove casualty's short link karabiner.

Method 2 - descend with casualty:

- Rescuer rigs a set of ropes as close to the casualty as possible. Make sure the ropes are rigged as high as possible, to give yourself enough headroom.
- It will not be possible to do a standard counter-balance rescue here as the casualty will be higher than the rescuer and there is a greater chance of getting stuck.
- Rescuer attaches casualty's descender and back-up device on to ropes.
- Rescuer attaches back up cow's-tail to casualtie's central 'D' ring.
- Rescuer attaches short connection between casualty's descender karabiner and rescuer's central 'D' ring (the casualty now has two independent attachments to the rescuer).
- Rescuer attaches counterbalance sling directly into harness webbing and feeds sling through eyebolt, extend the sling using an etrier (this will prevent your foot getting jammed against the eyebolt when lowering the casualty). Unscrew the short link karabiner.
- Perform a counterbalance rescue; remove casualty's short link karabiner.
- Rescuer will be hanging from casualty, control the casualty's descender with extra friction and descend to ground, keeping the back-up device high and carefully lands casualty.

LEGISLATION

FOR MORE INFORMATION SEE IRATA ICOP SECTION 4

SET OUT BELOW IS THE MAIN LEGISLATION AND REGULATIONS THAT APPLY TO INDUSTRIAL ROPE ACCESS INDUSTRY IN THE UK (IF YOU ARE WORKING OUTSIDE UK JURISDICTION, THEN IT WILL BE NECESSARY TO FOLLOW LOCAL REGULATIONS. WHERE NO APPROPRIATE LOCAL LEGISLATION EXISTS IT WOULD BE ADVISABLE TO FOLLOW THE SPIRIT OF THE UK LEGISLATION), A BRIEF OUTLINE IS GIVEN BELOW OF THE PRINCIPAL REGULATIONS RELATING TO ROPE ACCESS WORK:

IRATA TACS 6.2.2

WAHR: The Work At Height Regulations 2005.

The aims are to ensure that work is planned and people are competent.

- **Avoid working at height.**
- **Prevent falls. Use an existing workplace or select the most suitable work equipment.**
- **Mitigate the consequences of a fall by minimizing the distance fallen.**

At all stages give precedence to collective measures (handrails, working platforms) before other methods, which may only mitigate the distance and consequence of a fall (nets and airbags) or may only provide personal protection (harnesses).

LOLER: The Lifting Operations and Lifting Regulations 1998

Three principal aims of LOLER are:

- **All lifting operations are properly planned and managed.**
- **Lifting equipment is used in a safe manner.**
- **Lifting equipment is thoroughly inspected at suitable intervals by a competent person.**

Lifting equipment means **work equipment** that lifts or lowers **loads** and includes its attachments used for anchoring, fixing or supporting it. For example:

- strops, chains, slings, eye-bolts, etc;
- anchorage equipment, e.g. rigging, and associated items used in rope access methods, including ropes, karabiners, harnesses and strops;

It is important to note that the term 'load' includes a person.
LOLER applies to a wide range of lifting equipment and lifting operations and now includes, for example:

- ropes and equipment used for work positioning (personal suspension equipment) during rope access work;

All work should be supervised by an IRATA level 3 supervisor.

Marking of lifting equipment

A declaration (or certificate) of conformity indicating the standard to which the equipment conforms, and information on any strength requirements should be available to the user.
All components of a rope access system should be identifiable in such a way that they can be easily associated with their respective documentation e.g. declarations of conformity, test certificates and examination reports. This may be by the manufacturer's batch marking or other forms of identification. A coding system could be used to provide the user with a cross-reference to any appropriate records, e.g. by the tagging of ropes etc. Marking of metal components should not be by stamping, unless by agreement with the manufacturer.

The regulations require lifting equipment to be marked to indicate its safe working load. Rope access equipment is specifically designed to support a person (in a rescue scenario there may be two people). Therefore, implicit in the use of the equipment - and the standards relating to its use - is the concept of a 'SWL' (as required by LOLER) in terms of body weight**.** All items of PPE and similar equipment are, therefore, automatically rated for a 'safe working load' of **one person** in normal deployment. However, because of the factor of safety built into the equipment (which varies from four to twenty-two, for single person use), in a rescue scenario the equipment could be used by two persons.

The user or operator is best placed to identify faults or damage to equipment and operatives should be authorised to withdraw from use any component of their working system that they consider necessary. In particular:

- there should always be a visual and tactile 'pre-use' check to identify obvious faults due to day-to-day wear and tear and failure or damage of all equipment, i.e. to ensure that the equipment will function correctly and is safe to use. Suspect items should be taken out of service and checked by a competent person to determine the appropriate action to be taken. Irreparable items should be rendered unusable and then disposed of.

LOLER requires lifting equipment to be **thoroughly examined**. You should identify all equipment that requires a **thorough examination.** Thorough examination should be undertaken by a **competent person**, who has appropriate practical and theoretical knowledge and experience of rope access equipment to enable them to detect defects or weaknesses and assess their importance in relation to the safety and continued use of the lifting equipment. Lifting equipment should be thoroughly examined before use for the first time and the manufacturer's declaration of conformity normally serves this purpose. Thereafter, where it is being used for rope access work, it should be thoroughly examined either:

- every six months, or;
- in accordance with time intervals specified in an **examination scheme** drawn up by a competent person.

MHSWR: The Management of Health and Safety at Work Regulations 1999.

MHSWR require a risk assessment to be carried out to identify the nature and level of the risks associated with task/job.

A **hazard** is something that could cause harm to a person or property.
A **risk** is the likelihood of that harm actually occurring.

Five steps for **risk assessment**:

1) Identify the hazards in the workplace.
2) Identify who could be harmed and how.
3) Evaluate the risks and decide on precautions.
4) Record the findings, implement them and inform team members and others.
5) Review the risk assessment and revise it when necessary

A **method statement** is a document stating the detailed sequence of events necessary for the safe execution of the task. It must be available on the job and everyone in the team must understand it. Typical contents of a method statement include:

- Scope of works.
- Team structure and qualifications.
- Detailed sequence of events.
- Special equipment and plant, tools, etc.
- Arrangements for safeguarding personnel and third parties including the public.
- Details of PPE and the other risk control measures.
- Emergency considerations such as rescue, evacuation and fire procedures.
- Details of anchors and rope systems.
- Communications.
- Arrangements for waste and housekeeping.
- How hazardous substances will be controlled.

Permit to work systems

A permit to work is a written document giving you authority to carry out work under certain conditions. It usually contains the risk assessment and method statement. The aim is control the work and prevent accidents and damage to plant. The reasons why permits are necessary is because you will be working in an environment that you can not readily understand such as offshore oil installation or nuclear power plant. A permit to work should be understood by everyone involved with the job.

Exclusion Zones

Exclusion zones may need to be set up to protect people from falling, or to protect people against falling objects from above the area of rope access operations or anyone below. Exclusion zones may be necessary at several levels, e.g. above anchor level, at anchor level, at intermediate levels and at ground level.

Exclusion zones established to protect against falling objects should minimise the risk of being struck by those objects. Where reasonably practicable, the width of the exclusion zone should be at least equal to the height of the work position. Account should be taken of the possibility of material deviating from a straight fall as a result of wind or after bouncing off the structure or the ground. People should be discouraged or prevented from entering the exclusion zone or interfering with the rigging by posting suitable notices, providing warning signs, erecting appropriate barriers or installing alarms. Access ways, passageways or doors leading into the zone should be suitably controlled. It should be noted that the control of fire escapes and disabled access points need to be agreed with the building/structure owner or managers.

The Personal Protective Equipment Regulations 2002

When PPE is purchased a certificate of conformity stating that the product meets the requirements of the PPE regulations and conforms to the standard it claims to meet should be supplied. CE marking is not intended as a sign

of quality or as proof of origin. It is purely administrative, indicating to the authorities that the product bearing the mark can be put into circulation anywhere within the single European market.

The main aims of the regulations are:

- Employers must provide suitable and sufficient PPE when there is a risk to Health and Safety that cannot be eliminated or minimised in some other way.
- Employers must supply training and information about the hazards and how to use the PPE and make sure it is being used.
- PPE must be inspected, maintained and stored correctly.
- Employers must use the PPE provided, not interfere with it and report any defects or deficiencies in use.

There are three categories of PPE:

- Category 1 - Simple e.g. for protection against minor risks e.g. non-specialist overalls, gardening gloves
- Category 2 - Intermediate e.g. for protection against serious risks e.g. helmets, protective footwear
- Category 3 - Complex e.g. for protection against mortal danger e.g. harnesses. Most rope access equipment is classed as PPE category III. In this case, the equipment also has to carry the number of the notified body, i.e. the body responsible for checking that the product conforms to the directive, after type testing to the standard by an independent test house.

COSHH – The Control of Substances Hazardous to Health Regulations 2002

COSHH regulations require employers to protect staff and other people against health risks that may arise from work activities with hazardous substances. COSHH is about the effect the substance will have on a person not the PPE.

Hazardous substances include any material, mixture or compound used or produced at work which are harmful to peoples health in the form in which they occur in the workplace.
They include:

- Chemicals.
- Carcinogens, mutagens or reproductive toxins.
- Dusts or fumes.
- Asphyxiants.
- Other substances hazardous to health.

Material Safety Data Sheet (MSDS) will provide information about the type of hazards involved in handling, storing and transporting the material. It should also provide a list of active ingredients as well as information about disposal hazards and any adverse effects on the environment.

A COSHH risk assessment should be produced in order to eliminate the need for the substance if possible, substitute it for a less hazardous material, change the nature of the substance by dilution, pellets instead of powder. Any residual risk can be lessened by the use of PPE. Control measures are always a mixture of equipment and ways of working to reduce exposure. The right combination is crucial. No measures, however practical, can work unless they are used properly.

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