besafety

Manual de treinamento IRATA

Manual de treinamento móvel para o programa IRATA de acesso por cordas.

PT-BR · 2026

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CAPÍTULOS · 01

Introduction

The importance of training, what this manual is, and the IRATA training, assessment and certification scheme.

Introduction

This manual supplements your **Industrial Rope Access Training Course**, leading to certification issued by the Industrial Rope Access Trade Association (IRATA).

It is not a substitute for practical training and should be used in conjunction with:

- **IRATA Publication: ICOP** (International Code of Practice)
- **IRATA Publication: TACS** (Training, Assessment & Certification Scheme)

> ⓘ **Course title**
>
> This manual covers **All IRATA Levels** (Level 1, 2 and 3).

Seek guidance from your instructor on which sections of this manual you need to read and understand for your own assessment, and on any sections that are not clearly understood.

Importance of training

Why safety must always be the prime consideration in industrial rope access.

Importance of training

Rope access techniques have been used extensively in industry since the mid-1980s. Before this time the techniques were used in the sports of caving and climbing.

Recreational cavers and climbers accept calculated risks as part of their sport. Decisions are taken to reduce the level of equipment whilst replacing it with increased levels of strength, skill and technique. This lightweight, higher-risk approach is considered to be an enjoyable and positive aspect of caving and climbing as a sport.

The approach taken by the rope access technician is **quite different** because safety must be the prime consideration in the industrial environment. Nothing is ever left to chance and access is achieved with appropriate equipment and a **100% redundant back-up system**.

⛔ **The statistic that drives our training**

Approximately **60% of all fatalities in the construction industry are as a result of a fall**, and a fall of less than 2m. Many of these fatalities could have been avoided, had the individual been using the appropriate Personal Protective Equipment (PPE) and received proper and adequate training in its use.

Persons not using the correct PPE, or attempting to use it without proper and adequate training, are a danger to themselves and others, and are committing an unlawful act that could lead to prosecution.

It is essential that rope access personnel have the appropriate personal protective equipment for the task and have adequate training in all aspects of its correct use, care and maintenance.

During your course you will be taught to use the various access techniques and devices in a safe and controlled manner, always under the direct supervision of your instructor.

⚠ **SAFETY**

SAFETY will always be of paramount importance.

IRATA training & certification scheme

Levels 1, 2 and 3 — entry requirements, training, assessment and revalidation.

IRATA training, assessment & certification scheme

IRATA operates a three-level certification scheme. Independent IRATA re-assessments are required **every three years** at all levels, following a minimum of four days of training.

Level 1 — Rope access technician

- **Entry**: minimum age 18; no previous experience required; aptitude for working at height.
- **Training**: minimum 4-day training course.
- **Assessment**: 1-day independent assessment.
- **Validity**: 3 years.

Level 2 — Rope access technician

- **Entry**: minimum 12 months experience as Level 1 and **1000 logged working hours**, before expiry date.
- **Training**: minimum 4-day training course in rope access, rigging and rescue.
- **Assessment**: 1-day independent assessment.
- **Validity**: 3 years.

Level 3 — Rope access technician (supervisor)

- **Entry**: minimum 12 months experience as Level 2 and **1000 logged working hours**, before expiry date.

- **Training**: minimum 4-day training course in advanced rope access techniques.
- **First-aid training** required.
- **Assessment**: 1-day independent assessment.
- **Validity**: 3 years.

IRATA International training, assessment and certification scheme.

> ⓘ **Revalidation timing**
>
> Re-assessment may be done up to **6 months before** the due expiry date without any time penalty. Technicians whose certificates have been expired for **more than 6 months** should contact an IRATA International trainer member company for information on the revalidation procedure (see IRATA document 032 — Procedures for IRATA registrations and direct entry).

> ⚠ **Refresher training**
>
> Rope access technicians **not engaged in rope access work for six months or more** should attend refresher training before returning to work.

What you're assessed on

Each candidate is graded on planning & management, equipment, rigging, rigging for rescue & hauling, rope manoeuvres, climbing techniques, rope rescues and climbing rescues.

Results are recorded on the IRATA Assessor Assessment Checklist (Form 060) as:

- **P** — Pass
- **Dis** — Minor Discrepancy
- **F** — Fail
- **A** — Awareness only (used under direct supervision)

Your instructor will brief you on the specific items required at your level.

CAPÍTULOS · 02

About IRATA

IRATA's mission, and the moral, economic and legal reasons for maintaining the highest safety standards.

About IRATA

The purpose of IRATA is to ensure that any rope access work done by its members is carried out in a safe and high-quality manner. It was established in the late 1980s following an initiative by leading rope access companies, and is fully supported by the HSE.

IRATA's mission

The aims and activities of the Industrial Rope Access Trade Association.

IRATA's mission

IRATA's mission is:

- To aim for **zero errors and accidents** in safety and work quality.
- To provide Association representatives able to give informed opinion and advice to external bodies such as CEN and BSI.
- To prepare submissions to government departments on matters such as health and safety and training — e.g. Department of Trade and Industry, Department of Energy, Health & Safety Executive.
- To assist working parties charged with commenting on and discussing existing and draft legislation directives.
- To indicate areas of research and development where initiatives are required to solve problems facing the industry.
- To assist in the provision of appropriate educational training and certification opportunities for personal employment in industrial rope access.
- To provide a forum for the free and informal exchange of experience and opinion.
- To provide guidance on training and certification of personnel involved in industrial rope access and guidance on good working practice.

Controlling hazards & reducing risk

The moral, economic and legal reasons for maintaining high safety standards.

Controlling hazards & reducing risk

There are three reasons why you need to maintain high standards of safety in rope access:

Moral

British society places safety at work high on its moral agenda and will generally react against individuals or companies who place themselves and the public at risk.

Economic

Accidents lead to losses. Companies become bankrupt and individuals lose time off work, or are unable to work again.

Legal

Not complying with the health and safety regulations can lead to **criminal prosecution** of directors and employees, with a penalty of hefty fines and/or imprisonment.

Rope access is a safe method of working because technicians understand their health and safety duties to themselves, colleagues and members of the public.

CAPÍTULOS · 03

Legislation

The UK statutory framework that governs work at height: HSE Act, WAHR, MHSW, LOLER, PUWER, COSHH, PPE, Noise, Manual Handling and RIDDOR.

Legislation

This chapter sets out the UK industrial law that governs rope access work — from the overarching **Health & Safety at Work etc. Act 1974** down to the specific regulations on lifting equipment, PPE, hazardous substances and accident reporting.

Most of these regulations are enforced by the **Health & Safety Executive (HSE)**. Failure to comply can lead to criminal prosecution.

Health & Safety at Work etc. Act 1974

The general duties of employers, employees and the self-employed.

The Health & Safety at Work etc. Act 1974

This Act sets out the general duties which **employers** have towards employees and members of the public; and **employees** have to themselves, their colleagues and the public. Regulations have been passed in recent years to support the Act.

Employers' duties

Employers are under a general duty to ensure, **so far as is reasonably practicable**, the health, safety and welfare of all their employees at work. This includes:

- ✓ The provision and maintenance of plant and systems of work that are safe and without risks to health.
- ✓ Making arrangements to ensure safety and the absence of risks to health in connection with the use, handling, storage and transportation of articles and substances.
- ✓ The provision of information, instruction, training and supervision as is necessary to ensure the health and safety at work of their employees.
- ✓ The maintenance of any place of work under their control, in a condition that is safe and without risks to health, and the provision and maintenance of a safe means of access to, and egress from, the place of work.
- ✓ The provision and maintenance of a working environment for employees which is safe, without risks to health, and adequate with regard to facilities and arrangements for their welfare at work.

Employees & self-employed persons' duties

Employees and self-employed persons are under a duty to take reasonable care for the health and safety at work of themselves and any other people who might be affected by

their acts or omissions, and to co-operate with their employers and others to enable them to comply with statutory duties and requirements.

⛔ **Misuse**

In addition, they must not intentionally or recklessly misuse anything provided in the interests of health, safety and welfare in the pursuance of any aspect of health and safety law.

The HSE: Guidance, Codes of Practice & Regulations

The three tools the HSE uses to supplement existing arrangements.

The Health & Safety Executive

The Health and Safety Commission (HSC) and its operating arm, the Health and Safety Executive (HSE), have spent the last twenty years modernising the structure of health and safety law.

Three things prompt action

1. Changes in technology, industries or risks.
2. Evidence of accidents and ill health, plus public concern.
3. Receiving European Directives.

The HSE has **three main options** when action is necessary to supplement existing arrangements.

1. Guidance

Guidance can be specific to the health and safety problems of an industry or of a particular process used in a number of industries. Its purposes are:

1. To help people **understand** what the law says.
2. To help people **comply** with the law.
3. To give **technical advice**.

Following guidance is not compulsory and employers are free to take other action — but if they do follow guidance, they will normally be doing enough to comply with the law.

2. Codes of Practice (COP)

Codes of Practice offer practical examples of good practice. They give advice on how to comply with the law — for example, by providing a guide to what is "reasonably practicable" or what "suitable and sufficient" means in particular circumstances.

> ⚠ **Special legal status**
>
> If employers are prosecuted for a breach of health and safety law, and it is proved that they have not followed the relevant provisions of an Approved Code of Practice, **a court can find them at fault** unless they can show they have complied with the law in some other way.

3. Regulations

Regulations are law, approved by Parliament and usually made under the Health and Safety at Work etc. Act 1974.

Where risks are so great, or control measures so costly, that it would not be appropriate to leave employers discretion, regulations identify those risks and set out **specific action that must be taken**. Often these requirements are absolute.

Some regulations apply across all industries (e.g. Manual Handling). Others apply to hazards unique to specific industries (e.g. the offshore oil and gas industry).

Work at Height Regulations 2005

The Avoid-Prevent-Minimise hierarchy and the duties imposed on duty-holders.

Work at Height Regulations

The **Work at Height Regulations 2005** address all issues surrounding working at height, in all industries. Following the risk assessment, the hierarchy below should allow you to select the most appropriate methods for work at height.

The overriding principle is to prevent, as far as is reasonably practicable, any person falling a distance likely to cause personal injury.

The hierarchy

1. **AVOID** the risk by not working at height — where it is reasonably practicable to carry out the work safely other than at height, then you should do so.
2. **PREVENT** falls — where avoidance is not reasonably practicable, assess the risks and take measures to allow the work to be done whilst preventing, so far as is reasonably practicable, people or objects falling. This might include carrying out the work from an existing safe place of work, or choosing the correct work equipment.
3. **MINIMISE** the consequences of a fall — where the risk of falling still remains, take steps to minimise the distance and consequences.
4. At all stages give **COLLECTIVE** protective measures (e.g. scaffolding, guardrails, nets, airbags) **precedence over personal protective measures** (e.g. safety harnesses).

⚠ **Collective before personal**

Personal fall protection (like a harness and rope system) is only appropriate when collective protection isn't reasonably practicable.

What WAHR requires of you

- ✓ Assess the risk to help you decide how to work safely.
- ✓ Follow the hierarchy: Avoid, Prevent, Minimise — give Collective measures priority.
- ✓ Plan and organise your work properly, taking account of weather conditions and the possibility of emergencies (e.g. worker suspended from a lanyard).
- ✓ Ensure those working at height are competent to do so.
- ✓ Make use of appropriate work equipment.
- ✓ Manage the risks from working on or around fragile surfaces and from falling objects.
- ✓ Inspect and maintain the work equipment to be used, and inspect the place where the work will be carried out (including access and egress).

LOLER 1998

Lifting Operations and Lifting Equipment Regulations — the framework that governs rope access kit.

LOLER — Lifting Operations & Lifting Equipment Regulations 1998

LOLER has had a major impact on the rope access industry since its introduction. The term **'Lifting Equipment'** means work equipment that lifts, supports or lowers a **Load** and includes the attachments used for anchoring, fixing or supporting it.

> ⓘ **The Load includes a person**
>
> The term **'Load' includes a person**. LOLER therefore applies to many items used in rope access work including ropes, harnesses, carabiners, strops, anchorages and rigging equipment.

The three principal aims of LOLER

1. **Lifting operations are properly planned and managed.**
2. **Lifting equipment is used in a safe manner.**
3. **Lifting equipment is thoroughly examined at suitable intervals by a competent person.**

Strength

Lifting equipment must have adequate strength for its intended use. Equipment should be selected which meets the standards relevant to its intended use.

Stability

Ensure the lifting equipment has adequate stability and will not collapse or overturn when working. Where lifting equipment is anchored to other work equipment or structures, these must be able to withstand the forces that may be imposed upon them.

Lifting people

> ⛔ **Lifting people**
>
> You must eliminate the risk of a person falling by using an independent back-up system, carrying out daily inspections and ensuring operatives receive adequate training. In an emergency, a reliable and fail-safe rescue plan should be in place.

Marking of lifting equipment

All lifting equipment should be marked with its **Safe Working Load (SWL)**. Rope access equipment is designed specifically to support the weight of one person, and is automatically rated with a SWL of one person in normal use.

In the event of a rescue this can be increased to two people due to the factor of safety built into the equipment — but this should only be done by specifically trained and competent persons who will avoid generating large dynamic forces.

Because most rope access equipment is subject to particular service conditions (different sized and types of rope with varying levels of wear), it is not generally marked with a SWL. Instead the user information supplied with the product defines the SWL or WLL that can be applied in certain configurations — usually **80kg, 100kg or 150kg** depending on the EN Standard it has been tested to.

All components of a rope access system should be identifiable in such a way that they can be traced back to their documentation — declarations of conformity, test certificates and examination reports.

Organisation of lifting operations

- Work should be properly planned by a competent person, adequately supervised, and carried out in a safe manner.
- Work teams should be made up of at least **2 persons**, one of whom is deemed competent to supervise.
- **An IRATA Level 3 technician should supervise all rope access work.**

> ⚠ **Third parties**
>
> Third parties should be excluded from around the anchors and, where possible, from the area below the rope access work, by the use of appropriate barriers and sentries if required.

Planners should take account of visibility and communication between technicians, the work environment (e.g. wind, rain, ice, emissions), and any hazards in the area (e.g. high voltage lines, hot works, abrasion, chemicals).

Thorough & periodic examinations

LOLER requires all lifting equipment to be **Thoroughly Examined**:

1. **Before first use** (the declaration of conformity normally serves this purpose).
2. **Upon receiving the item from a third party.**
3. **Every six months**, or at intervals specified in an examination scheme drawn up by a competent person, taking account of manufacturer's recommendations and work conditions.

Lifting equipment should also be examined each time exceptional circumstances occur which could jeopardise its safe use.

Periodic Examinations should be carried out additionally where the risk assessment has identified high wear and tear in the period between Thorough Examinations.

> ⓘ **Competent persons only**
>
> Only competent and impartial persons with appropriate knowledge and experience may carry out a thorough examination or periodic inspection. The competent person should make a

written report of the state of the equipment at the time of the examination.

If a defect is discovered which could become a danger, the employer should be informed and the lifting equipment **quarantined against further use** until the defect is rectified.

⛔ **Pre-use checks are also mandatory**

In addition to the above examinations, **ALL** lifting equipment must undergo a **PRE-USE CHECK** prior to the commencement of each and every use. There is no requirement for the results of this pre-use check to be recorded.

Records

A certificate of conformity indicating the standard to which the equipment conforms, and any strength requirements, should be made available to the user. All components of the rope access system should be traceable to the certificates of conformity and examination reports. A coded marking system should be used.

- Certificates of conformity should be kept **as long as the equipment remains in use**.
- Thorough examination reports for the **previous two years** should be made available for inspection by the authorities.

PUWER 1998

Provision and Use of Work Equipment Regulations — for all work equipment, not just lifting kit.

PUWER — Provision & Use of Work Equipment Regulations 1998

PUWER supports the LOLER regulations. **BS 7985 'Code of Practice for the Use of Rope Access Methods for Industrial Purposes'** references PUWER for the supply and safe use of **all work equipment** — both personal suspension equipment and other tools, machinery etc. used on the worksite.

Suitability of work equipment

All work equipment should be constructed or adapted as to be suitable for the purpose for which it is used or provided. The selection of work equipment must have regard to working conditions and any additional risks posed by its use. The equipment must be used only for operations, and under conditions, for which it is suitable.

Maintenance

Employers and others are to ensure that work equipment is maintained in an efficient state, in efficient working order, and in good repair. Where the machinery has a maintenance log, the log must be kept up to date.

Specific risks

The use of equipment is restricted only to competent persons who are given the task of using it. Only suitably competent persons can maintain or repair equipment.

Information, instructions & training

Users and supervisors of equipment must be given adequate health and safety information and, where appropriate, specific written instructions relating to its use. They must also receive adequate safety training, including:

- How to perform pre-use checks (e.g. cables checked, coiled wires unreeled).
- How the equipment may be adapted in use and any risks which may then arise.
- The precautions to be taken.

Prevention of dropping tools

⚠ **Small tools (< 8 kg)**

Whilst working at height, tools weighing less than 8 kg should always be attached to the operative by means of a **lanyard**. Where a number of small tools are to be used, it may be appropriate to have small loops tied to each, stored in a tool sack — a single lanyard may then be clipped to each tool in turn whilst still in the sack and safely used.

⛔ **Larger tools (> 8 kg)**

Whilst working at height, tools weighing more than 8 kg should always be attached to an **independent safety line** — not the operative.

COSHH 2002

Control of Substances Hazardous to Health — and the effect of chemicals on rope access equipment.

COSHH — Control of Substances Hazardous to Health Regulations 2002

Using hazardous substances can put people's health at risk. COSHH requires employers to:

1. Assess health risks to technicians and others.
2. Act to prevent or control exposure to substances.
3. Provide and maintain safety control measures.
4. Monitor and record measures and employees' health.

What is a hazardous substance?

Hazardous substances include any material, mixture or compound used or produced at work which is harmful to peoples' health in the form in which it occurs in the workplace. They are found in nearly all workplaces — factories, bridges, oil platforms, office blocks. They can include:

- **Substances used directly in work activities** — glues, paints, cleaning agents.
- **Substances generated during work activities** — rock-wool or cement dust, new compounds from mixing chemicals.
- **Naturally occurring substances** — pigeon droppings, blood, bacteria, grain and dust.

MSDS and CHIP

The Chemicals (Hazard Information and Packaging for Supply) Regulations 2002 (**CHIP**) require commercial chemicals to be supplied with a **Materials Safety Data Sheet (MSDS)**

which provides information about the types of hazards involved in handling, storing and transporting the material.

It should provide a list of active ingredients as well as information about disposal hazards and any adverse effects on the environment.

This information may not be sufficient to safeguard your health and safety. You should produce a COSHH risk assessment in order to:

- Eliminate the need for the substance if possible.
- Substitute it for a less hazardous material.
- Change the nature of the substance (dilution, pellets instead of powder).
- Look at methods to minimise risk.

Any residual risk can then be lessened by the use of PPE.

Effects on rope access equipment

> ⚠ **MSDS doesn't cover textiles**
>
> Generally the MSDS sheet will **not** show the effects chemicals have on ropes and harnesses. It will often be necessary to consult with both the chemical and the equipment manufacturer to verify that the chemical will have no harmful effects on the equipment. Specific testing may be required to verify this.

Noise at Work 2005

Action levels for daily personal noise exposure.

Noise at Work Regulations 2005

The Noise at Work Regulations 2005 require action to be taken to protect employees from hearing damage at each of the following action levels.

Level	Threshold
First Action Level	80 dB(A) daily or weekly personal noise exposure ($L_{EP,d}$)
Second Action Level	85 dB(A) daily or weekly personal noise exposure ($L_{EP,d}$)
Peak Action Level	87 dB(A) daily or weekly personal noise exposure ($L_{EP,d}$)

Generally, where there is an excessive noise problem on a site, suitable ear protectors are provided close to where you enter the noisy area.

Manual Handling Regulations 1992

Assessing the risks of moving objects by hand or bodily force.

Manual Handling Operations Regulations 1992

The Manual Handling Operations Regulations 1992 require employers to assess the risks associated with moving objects by hand or bodily force, with the aim of eliminating or minimising the risk of injury or long-term health problems.

All manual handling has to be within the capability of the technician. Manual handling risk assessments can be applied to assess tasks that could pose a risk of acute or chronic injury or condition.

> ⚠ **In rope access**
>
> Consideration should be given to the effects of manual handling operations during **hauling and counter-weighting** exercises, and where lifting operations are carried out when your feet are not against a solid structure.

Guideline weights

Approximate maximum loads when handling at various heights:

Height	Women	Men
Shoulder	3 / 7 kg	5 / 10 kg
Elbow	7 / 13 kg	10 / 20 kg
Knuckle	10 / 16 kg	15 / 25 kg
Mid-lower-leg	7 / 13 kg	10 / 20 kg
Floor	3 / 7 kg	5 / 10 kg

The lower figure is for handling at arm's length; the higher figure for handling close to the body.

HSE manual-handling guideline weights by height and reach (women / men).

PPE Regulations 1992

Categories of personal protective equipment and the inspection frequencies that apply.

PPE — Personal Protective Equipment at Work Regulations 1992

The Personal Protective Equipment at Work Regulations 1992 require that:

1. Employers provide suitable and sufficient PPE when a risk to health and safety cannot be eliminated or minimised in some other way.
2. Employers supply training and information about the hazards and how to use the PPE. They also have to ensure the PPE is being used (e.g. supervision, safety audits).
3. PPE is inspected, maintained and stored correctly.
4. Employees use the PPE provided, do not interfere with it, and report any defects or deficiencies.

Categories of PPE

Category	Level	Examples
Category I	Simple	Gardening gloves, non-specialist coveralls
Category II	Intermediate	Industrial safety helmets, protective footwear
Category III	Complex	For protection against mortal danger

> ⚠ **Helmets for fall protection**
>
> Industrial safety helmets are Category II PPE — but helmets that give protection against falls from height are generally **Category III**.

Most rope-access suspension equipment falls into **Category III** and must undergo independent type testing, usually to European Performance (EN) standards.

The equipment must be supplied with appropriate technical and user instructions and must be manufactured under an independently verified quality system (e.g. ISO 9000), or be subject to periodic independent batch testing.

Inspection frequencies

The PPE Regulations require components to be examined **at least every twelve months**.

HSE Specialist Inspector Report No. 59 recommends that, for textile items, the frequency should be increased:

- **Every six months** as a baseline.
- **Every three months or more frequently** for "arduous environments" if the risk assessment shows special hazards.

> ⛔ **Construction = arduous**
> Work on a construction site would normally constitute an **arduous environment**.

Why this matters

IRATA's accident statistics show that the **majority of reported accidents** have been minor and have involved operatives not wearing appropriate PPE — in particular suitable **gloves and eye protection**.

Operatives are encouraged to wear the appropriate PPE for the full duration of the work activity creating the hazard.

RIDDOR 1995

When and how to report accidents, diseases and dangerous occurrences.

RIDDOR — Reporting of Injuries, Diseases & Dangerous Occurrences Regulations 1995

Reporting specified injuries, diseases and dangerous occurrences is a legal requirement under RIDDOR.

When you must notify immediately

If there is an accident connected with work and:

1. An employee or self-employed person is **killed** or suffers a **major injury** (including as a result of physical violence), **or**
2. A member of the public is killed or **taken to hospital**;

...you must notify your **company-nominated person immediately** (e.g. by telephone) so they can notify the enforcing authority without delay.

What to record

You will need to record and provide details about:

- The work situation.
- The injured parties.
- The accident itself.

ⓘ **At the scene**

Take **photographs, measurements and make detailed notes** as soon as possible after the incident.

A completed accident report form **F 2508** must follow the initial notification within **ten days**.

Over-three-day and near-miss reporting

In addition, any accident where the time lost by the injured person is **over 3 days**, or any **dangerous occurrence** seen, should also be reported to your company-nominated person.

Near misses should also be reported to your employer to assist in achieving the aim of continuous improvement of working methods.

Any **Principal Contractor** governing your site will also have to be informed.

CAPÍTULOS · 04

Risk assessments & method statements

Identifying hazards, evaluating risks, recording findings, writing method statements and operating permit-to-work systems.

Risk assessments & method statements

The **Management of Health and Safety at Work Regulations 1999 (MHSW)** require employers to:

- Produce **risk assessments** and **method statements**.
- Take measures to eliminate or reduce risks to your health and safety.
- Appoint competent people.
- Provide you with the appropriate access system, information, instruction and training.

As an employee (or contracted self-employed person) you are required to comply with any health and safety training and instructions provided, inform your employer of any shortcomings in that provision, and report any dangerous situations you find developing on site.

Risk assessment — the five-point plan

How to identify hazards, evaluate risk, apply controls and record your findings.

Risk assessment

A **risk assessment** is a careful, systematic examination of the hazards in your place of work that could cause harm to people or damage plant or property. It is to be done **before** the work takes place and **before** the work and access equipment is selected.

- A **HAZARD** is something that has the potential to cause harm to any person, property or animal.
- A **RISK** is the likelihood of that harm actually occurring.

When carrying out a risk assessment, identify the significant hazards, evaluate the level of associated risk and indicate whether existing precautions are suitable to eliminate or minimise it. Any judgement of the risk should take account of the **total number of persons** who could be harmed and the **severity** of that harm.

The five-point plan

1. Identify hazards in the workplace

- Consider the area in which the rope access team is expected to operate and identify any hazards that could reasonably be expected to cause harm to your team members.
- Look at how anything you do may create a hazard for others. Prioritise hazards that could result in major harm or affect several people.
- Consider what effects other people may have on your team's safety.

2. Identify who could be harmed and how

Identify which team members and any others who are at risk from each hazard.

3. Evaluate the risks and decide whether precautions are adequate

One method of evaluating risk uses the formula:

> ***"RISK = Frequency × Severity"***

Frequency of an accident occurring has the values:

1. Highly improbable
2. Remotely possible but known to occur
3. Infrequent
4. Occasional
5. Frequent and regular

Severity of the consequences has the values:

1. Minor injury, no time off
2. Injuries resulting in up to 3 days off work
3. Injury resulting in more than 3 days off work
4. Major disabling injury (loss of limb, eye etc.)
5. Fatality

Multiplying the numbers together produces a **risk rating**:

Risk rating	Score
Critical	15–25
Significant	8–12
Minor	1–6

ⓘ **A subjective method**

This method of evaluating risk is subjective, based on a broad judgement of the values attached to frequency and severity. However, it is fast becoming the industry-accepted method of prioritising or rating risks for attention.

Hierarchy of control measures

If further precautions are necessary, apply the following hierarchy:

1. **Remove** the hazard completely.
2. Try a **less hazardous** material or option.
3. **Prevent access** to the hazard.
4. **Organise work** to reduce exposure to the hazard.
5. Increase the level of **information, training and supervision**.
6. **Issue PPE** and provide welfare facilities (e.g. washing facilities).

4. Record your findings and inform team members & others

Write down the findings and state how you will eliminate the hazard or control it down to an acceptable level. Communicate to all team members.

They must understand and comply with the contents of the risk assessment and the measures put in place to reduce the level of risk. If other people are in or around your team's worksite, inform them about any risks your work could cause them and what precautions are being taken.

> ⚠ **Legal record-keeping**
>
> The law requires that if there are 5 or more employees, all the significant findings from the risk assessment **must be recorded**. A record should also be kept if the activity involves high levels of risk — this will include most rope access activities.

A risk assessment should include:

- A statement of the significant hazards identified.
- The control measures in place and the extent to which they control the risks, plus the options and methods available for workmate rescue (cross-referenced to other documents).
- The persons exposed to the risks.

Keep the risk assessment for future reference.

5. Review and revise

Review your risk assessment at regular intervals and revise it when the situation changes:

- Hazards may change in the same environment over time.
- New equipment, procedures or materials cause new hazards.
- Changing working environments may introduce significant new hazards.
- Young or inexperienced workers joining the team may require further actions.

Safety method statement

The contents and uses of a safety method statement.

Safety method statement

A Safety Method Statement is prepared from the results of the Risk Assessment. It states the **sequence of events** necessary for the safe execution of the task.

It should be reasonably detailed, setting out the general principles and working procedures for each part of the task. The Safety Method Statement must be shown to, and fully understood by, **all members of the team**, and made freely available to them for the duration of the work.

> ⚠ **When the work scope changes**
>
> During operations, should you be required to gain access to a new area or use techniques not covered in the Safety Method Statement, appropriate documents should be added to highlight the changes. Any new documents must be shown to, and understood by, all members of the team before the new work is carried out.

Upon completion the Method Statement should be filed away with the Risk Assessment.

Contents of a Safety Method Statement

- ✓ Introduction, originator and date.
- ✓ Copy of the relevant Risk Assessment.
- ✓ Detailed sequence of events, including hazard identification and risk control measures.
- ✓ Scope of works.
- ✓ Details of all personnel — qualifications, levels of competency, training requirements and team structure. Names of the people responsible for co-ordinating and controlling safety arrangements.
- ✓ Special equipment, plant and machinery requirements (including certification where applicable).
- ✓ Arrangements for safeguarding personnel and third parties, including the general public; exclusion of third parties from the work area; details of areas outside the site boundaries that

may need control during critical aspects of work.

- ✓ Emergency considerations such as rescue, evacuation and fire procedures.
- ✓ Locations and means of fixing the stability of any lifting equipment to be used.
- ✓ Details of PPE and other risk control measures to be used.
- ✓ Communications.
- ✓ Welfare arrangements.
- ✓ Permits to Work / isolation of services.
- ✓ Arrangements for temporary services required (e.g. toilets, electricity).
- ✓ Arrangements for the control of site transport.
- ✓ Any environmental limitations that may apply (wind speed, rain, temperature).
- ✓ Arrangements for the disposal of waste.
- ✓ How hazardous substances will be controlled (COSHH).

Permits to work

When a permit-to-work system applies and how it must be observed.

Permits to work

Where the environment you are to enter contains hazards such as:

- Live electrical conductors
- Hot metal ducts or vents for steam and gases
- Entering into a confined space

...a **Permit to Work** system may be in operation. This will generally be obtained from the local issuing authority to ensure that such hazards are effectively isolated before work commences.

⛔ **Strict compliance**

The conditions relating to the Permit to Work system **should be strictly adhered to**.

CAPÍTULOS · 05

Equipment

The PPE and rope-access hardware that makes up an industrial rope-access kit — selection, standards, marking, inspection and storage.

Equipment

Every IRATA technician is responsible for inspecting their own equipment before each use. This chapter walks through the items in a typical rope access kit — harnesses, connectors, descenders, ascenders, back-up devices, ropes, webbing, lanyards and helmets — and the standards, inspection criteria and service intervals required by the regulations and manufacturers.

A typical personal set-up

1. **Wire anchor strop / textile sling**, or a secondary back-up "duck" device.
2. **Absorbica L57** and **ASAP / ASAP LOCK**.
3. **1 m dynamic EN 892 cow's tail × 2.**
4. **Isolated bull-nose** from a 4 m continuous EN 892 dynamic rope.
5. **Scaffold/Barrel** to connectors.

Personal equipment set-up. Numbered items match the list above.

Harnesses

Choosing the right harness — sit, full-body and combination — and the EN standards that apply.

Harnesses

Suitable harnesses should be chosen for the task and be of a design that will support the user in the correct position. The harness should be **comfortable**, allowing adequate movement of the user and the unhindered operation of other devices within the system.

Standards

Harnesses should conform to the relevant standards for their particular application.

- **Industrial sit harnesses** are designed for **Work Suspension** (though they may be used for Work Restraint also) and must conform to **EN 813**. Some satisfy EN 813 **and** also conform to the work-positioning standard **EN 358**.
- **Fall arrest** situations require a **full-body harness conforming to EN 361**.

Some **'combination'** sit harnesses also conform to the requirements of an EN 361 full-body harness, making them a useful dual-purpose harness. Other sit harnesses can be adapted by adding the correct **chest harness** and a special EN 361 attachment to connect the two.

⛔ **Mountaineering harnesses**

Mountaineering harnesses complying with **EN 12277 are NOT sufficient for industrial rope access use**.

Connectors (carabiners & Maillon Rapides)

Double-closure connectors, loading along the spine and the EN standards that apply.

Connectors

All connectors used in rope access should be of the **double-closure type** (e.g. screw-gate or screw-link), as these provide the required level of security from accidental detachment.

> ⚠ **Self-locking carabiners**
> Some self-locking connectors (e.g. twist-lock) may lead to **'rollout'** and detachment.

Where arboriculture (tree surgery) is carried out, connectors should be of the **'triple-closure'** variety, in accordance with the arboriculture Code of Practice.

Steel connectors should be chosen when making attachments to other metal anchors — for example, cables, eyebolts and hangers.

Choosing the right shape & size

The connector should be of such a design and size that it is able to **rotate freely on the anchor** without hindrance, and without loosening the anchor or putting incorrect loading on the connector.

> ⛔ **Load along the spine only**
> Carabiners should **only be loaded along the axis of their length** (on a line close to the spine). Attaching carabiners to multiple items of equipment, having more than two carabiners connected to each other where a shock load could occur, or attaching carabiners to items that are too large in diameter or of an irregular shape (angular steelwork) may cause undue loading and promote failure.

To avoid loading against the gate, it may be more appropriate to use a carabiner with a **captive eye** to maintain a lanyard or component in the intended position.

Suitably shaped **'Maillon Rapides'** may be more appropriate where permanent or semi-permanent attachments are required, or where multi-directional loading may occur.

Standards

- **Carabiner-type connectors**: conform to **EN 362**. The standard requires a Minimum Breaking Load (MBL) of **15 kN**, however **BS 7985 suggests an MBL of 25 kN**.
- **'Maillon Rapide' type connectors**: conform to **EN 12275 Q** or EN 362.

Descenders, ascenders & back-up devices

The three core moving-parts of any rope access system, and the standards that apply to each.

Descenders, ascenders & back-up devices

Descenders

Descenders are devices which attach the operative to the working rope and allow a **controlled descent**. They must give the user total control over the descending speed and not cause undue shock loading to the rope during braking.

The descender should be of a type that will:

- Stop the descent if control is lost by the operative.
- Cannot be accidentally detached from the rope once threaded.

Descender devices used in the rope access industry should conform to one of:

- **EN 12841 Type C**, or
- **EN 341 A** — the standard for descenders used in rescue systems.

Ascenders

Ascenders are attached to and used to climb the working rope. They should be of a type that:

- Cannot be accidentally detached from the rope once engaged.
- Causes the minimum amount of damage to the rope when in use.

⛔ **Avoid dynamic loading**

Dynamic loading on an ascender attached to the rope **must be avoided** as this can cause serious damage to the sheath.

Standards for rope adjustment devices are **EN 12841 Type B** or **EN 567**.

Back-up devices

These devices are attached to the safety rope and used in **addition** to any other equipment engaged on the working rope. Should the operator lose control of a descent/ascent, or the working rope fail, the back-up device should:

- Lock onto the safety rope.
- Help to absorb any shock loading generated without causing significant damage to the safety rope.

The **Petzl ASAP** fall arrest device meets the requirements of both **EN 12841 Type A** and **EN 353-2** — these being the standards for rope access back-up devices and mobile fall arrestors respectively.

⚠ **Two-person rescue**

The Petzl ASAP has proven to provide an improved level of protection than is currently provided by the Petzl Shunt. However, when used in a **two-person rescue** it is necessary to utilise a suitable **'high-energy' absorber** such as the **Petzl L57**.

Ropes — low stretch & dynamic

Kernmantel construction, EN 1891 A vs EN 892, and the fall factors each rope is designed to handle.

Ropes

Polyamide or polyester ropes of a **kernmantel construction** are normally considered suitable for rope access applications — constructed with a load-bearing core (**kern**) and an outer protective sheath (**mantel**) that provides resistance to both wear and the ingress of dirt and grit.

Low-stretch ropes (EN 1891 A)

Low-stretch ropes conforming to **EN 1891 A** (with a min. 10 mm Ø) should be used for general rigging. Testing requires:

- Minimum Breaking Load (MBL): **2200 kg**.
- Maximum elongation does not exceed **5%** (measured between a 50 kg pre-load and a 150 kg load).

Type A low-stretch ropes are also subjected to a series of **Fall Factor 1** tests with a 100 kg load, generally breaking after in excess of 10 FF1 falls.

> ⚠ **In practice**
>
> In practice, Low Stretch rope **should not be subjected to Fall Factors in excess of FF 0.3** and **should be retired after one fall**. The Working Load Limit of Low Stretch rope is **one tenth of its quoted minimum breaking load**.

Static ropes — a note

There are currently discussions amongst European Standards Committees about introducing a **Static Rope** (no stretch) for use in certain situations where the stretch in a

standard Low Stretch rope (e.g. on a tall structure) could allow a considerable fall should the main working rope fail. A suitable shock-absorbing element would need to be included.

Dynamic ropes (EN 892)

Dynamic ropes conforming to **EN 892 (UIAA 1) Full Rope**, with a min. 11 mm Ø, will stretch up to **8%** when an 80 kg load is applied, depending on the manufacturer. In a shock-loading situation they can stretch in excess of **50%**.

Instead of FF1, dynamic rope is subjected to **FF1.78** falls. They generally break after being subjected to in excess of **12 FF1.78 falls**.

> ⓘ **Industry best practice**
>
> Dynamic rope **should not be subjected to Fall Factors in excess of FF1** and should be retired after one fall. The Working Load Limit of a Dynamic rope is **'one person'**. In a FF1.78 situation using Fig. 8 knots, an EN 892 dynamic rope will reduce the impact force of an 80 kg mass to **< 12 kN** — double the industry standard.

When choosing the type of rope for a particular application, the need for **energy absorption** should be balanced against the need to avoid excessive elongation or retraction of the rope.

Webbing, slings, cow's tails & lanyards

Wire and textile slings, cow's tails and energy-absorbing lanyards — choosing and using.

Webbing, slings, cow's tails & lanyards

Wire rope slings

Where there is a risk of abrasion at anchorage points, wire rope slings should be chosen over textile webbing slings. Slings can be manufactured to any length but would generally have a min. Ø of **7 mm**.

Wire rope slings should conform to **EN 795 B** or have a **SWL of 500 kg** (Factor of Safety 5:1).

Webbing

Webbing-based equipment — slings, harnesses and lanyards — should be chosen so that any damage (through abrasion, cutting, excessive loading, heat, UV etc.) will become **immediately visible before significant loss in strength** occurs. Structural stitching is of a contrasting colour to that of the webbing to aid inspection.

Anchor slings made from textiles should:

- Have sewn joints.
- Have a minimum rated static strength of **22 kN**.

> ⚠ **Avoid larks foot**
>
> Due to the effects of localised abrasion and a **min. 20% strength reduction**, avoid attaching main anchorage slings with a **larks foot knot**.

Slings should conform to **EN 566, EN 795 B** or **BS EN 1492-2**, and lanyards to **EN 354**.

Cow's tails

Individually marked **cow's tails** connect the operative's harness to the safety or working rope (via the appropriate knots and 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.

Generally this requires them to be made from **dynamic rope conforming to EN 892 (UIAA 1) Full Rope**, min. 11 mm Ø.

The length of the cow's tail should be kept as short as possible and limited to the limit of the operative's reach when under tension.

How long can a cow's tail be?

If the longest cow's tail were 0.6 m in length, with a maximum Fall Factor of FF1 and **no shock absorption** allowed for, the maximum impact force generated with a 100 kg mass would be **6 kN (600 kg)**.

> ⓘ **Practical maximum**
>
> Allowing for the energy absorption of the rope and knots, a cow's tail could be up to **1 m in length with a maximum Fall Factor of FF1**. Where fall distances or fall factors are in excess of this then suitable **energy-absorbing lanyards** should be used.

Energy-absorbing lanyards

Energy-absorbing lanyards are used to connect an operative's fall arrest harness to a suitable attachment point on the structure. In the event of a fall the lanyard:

- Limits the fall height.
- Reduces impact forces on both the operative and the structure to **below 6 kN**.

The lanyard's webbing or rope construction should have a minimum rated static strength of **22 kN**. The longest length available is **2 m**; however lanyards should be chosen which reduce the potential fall distance to an absolute minimum.

Single vs double lanyards

- **Single energy-absorbing lanyards** protect a worker while entering a small hazardous area via a pre-installed safety harness eyebolt or temporary anchor strop. Also for connecting to a permanent fall arrest system such as a Latchway continuous wire system.
- **Double energy-absorbing lanyards** are required where progress around a structure is needed — ensuring continual attachment while progressing.

Helmets

Side-impact protection, chin straps and the EN standards that apply.

Helmets

The helmet should provide resistance to side impacts as well as from above. It should have a **fully adjustable head cradle and chinstrap** for comfort and to prevent accidental loss in the event of a fall.

Standards

Some models conform to:

- **EN 397** (industrial) in respect of the shell, and
- **EN 12492** (mountaineering) in respect of the 5 kN chinstrap.

> ⚠ **Hybrids aren't certified**
>
> These hybrid models **do not conform to any standard**, industrial or otherwise. EN 397 helmets with a full cradle and chin-strap assembly are generally deemed suitable, as the risk of a large fall during rope access operations is low.

Practical considerations

- Helmets **without a peak** are beneficial when working in a vertical environment — vision is not obscured whilst looking upwards.
- It is an advantage if the helmet allows for the installation of ear defenders and protective face shields.
- Helmets should always be used with the **chin strap fastened**.

> ⓘ **Rail network**

To avoid confusion with train signalling systems on the UK rail network, only **White helmets** are generally permitted.

Equipment strengths, WLL & SWL

Minimum Breaking Loads for the kit you'll see every day, and the difference between WLL and SWL.

Equipment strengths

Breaking strengths may vary depending on particular product specifications from different manufacturers. The following items show the **Minimum Breaking Loads (MBL)** allowable for each Equipment Standard.

Standard MBLs

Equipment	MBL
EN 1891 A Low-stretch kernmantel rope, 10.5 mm Ø	22 kN (2200 kg)
EN 362 Steel screwgate carabiner, 10 mm	15 kN (1500 kg)
EN 12275 Q / EN 362 Maillon Rapide, 10 mm	25 kN (2500 kg)
EN 566 Round webbing sling, 18 mm	22 kN (2200 kg)
BS EN 1492-2 Choked webbing roundsling (WLL 1000 kg)	56 kN (5600 kg)
EN 12278 Swing-side pulley	15 kN (1500 kg)

Devices in conjunction with rope (10.5 mm Ø Low Stretch, new)

Device	Behaviour
Descender (e.g. PETZL ID)	Begins to slip at loads circa **6 kN (450 kg)**. WLL = **150 kg**.
Ascender	Generally begins to damage the rope at loads circa **6 kN (600 kg)**. This figure can reduce to as little as **4.5 kN (450 kg)** due to age and wear. During EN 567 testing, an ascender should hold a **400 kg load for 3 minutes**.

> ⚠ **Normal vs rescue load**
>
> For normal operations both descender and ascender devices should be used to hold the weight of **one person only**. During an emergency a competent person may increase this load to a maximum of **two persons**.

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.

> ⓘ **WLL caveat**
>
> The WLL does **not** account for particular service conditions that may affect the final rating of the equipment.

Safe Working Load (SWL)

The **maximum load (as determined by a competent person)** which an item of lifting equipment may raise, lower or suspend **under particular service conditions**. The SWL can be **lower** than the WLL.

> ⛔ **Never exceed**
>
> The WLL (manufacturer) or SWL (competent person) **must NEVER be knowingly exceeded**. You should never exceed the SWL of the **weakest link** in the system.

Factors of Safety in rope access

As a general rule:

- **Wire slings, carabiners and Maillon Rapide connectors**: SWL = 1/5 of MBL → **FoS 5:1**.

- **Textile items (EN 566 / EN 795 B webbing slings, lanyards, ropes)**: WLL = 1/10 of MBL → **FoS 10:1**.
- **Lifting slings (BS EN 1492-2)**: quoted WLL has **FoS 7:1** (WLL 1000 kg = MBL 7000 kg).
- **Items without a clear BL (ascenders, descenders)**: SWL = **1 person** in normal use; **2 persons** in a rescue.

CE marking, certification & EN standards

What CE marking actually means, and a reference list of the European standards that apply.

CE marking & certification

CE marking

All Personal Protective Equipment must be **CE marked**. For Category III PPE, CE marking indicates that the product has been independently type tested and meets the basic requirements of the **Personal Protective Equipment at Work Regulations 1992**.

> ⓘ **Not a quality mark — strictly speaking**
>
> The prime function of CE marking is to protect against barriers to trade within the European Union. It is not meant to be taken as a mark of quality — although Category III PPE is subjected to such rigorous controls that this point could be argued otherwise.

> ⚠ **CE marking is necessary, not sufficient**
>
> CE marking alone does **not** mean the item is fit for the intended application. When purchasing or choosing an item of PPE, ensure it conforms to the **appropriate European standard** for that particular item and its intended use.

Certification requirements

A **Certificate of Conformity** should be obtained for the product, stating that it meets the requirements and conforms to any standard it claims to meet.

The PPE Regulations require:

- The product must undergo **independent type testing** to a particular standard.
- The manufacturer must install a **quality management** standard such as ISO 9000, **or**

- The manufacturer must subject the product to **regular batch testing** at an approved test house.

Key EN / BS standards for rope access

Some standards are *under revision* — check BSI for the most current revisions.

Standard	Subject
EN 166	Personal eye protection — specifications
EN 341	Descender devices
EN 352	Hearing protectors
EN 353-1 / 2	Guided fall arresters (rigid / flexible anchorage line)
EN 354	Lanyards
EN 355	Energy absorbers
EN 358	Work-positioning systems
EN 360	Retractable fall arresters
EN 361	Full-body harnesses
EN 362	Connectors
EN 363	Fall arrest systems
EN 364	Test methods
EN 365	General requirements for instructions and marking
EN 397	Industrial safety helmets
EN 564	Mountaineering accessory cord
EN 565	Mountaineering tape
EN 566	Mountaineering slings
EN 567	Mountaineering rope clamps (ascenders)

Standard	Subject
EN 568 / 569	Ice anchors / pitons
EN 696 / 701	Polyamide / general fibre ropes
EN 795	Anchor devices
EN 813	Sit harnesses
EN 892	Dynamic mountaineering ropes
EN 958	Via-ferrata energy absorbers
EN 959	Rock anchors
BS EN 1492-2	Textile roundslings
EN 1496 / 1497 / 1498	Rescue lifting devices / harnesses / loops
EN 1891	Low-stretch kernmantel ropes
BS 7883	Code of practice for EN 795 anchors (design, install, use, maintain)
BS 7985	Code of Practice for rope access methods for industrial purposes
BS 8437	Personal fall protection systems and equipment for the workplace
BS 8454	Delivery of training and education for work at height and rescue
EN 12275	Mountaineering connectors
EN 12277	Mountaineering harnesses
EN 12278	Mountaineering pulleys
EN 12492	Mountaineering helmets
EN 12841	Rope adjustment devices for work positioning
EN 45014	Suppliers' declaration of conformity

Equipment marking & traceability

Why and how to mark each item so it can be traced back to its documentation.

Equipment marking

Equipment should be indelibly marked so that it may be individually traced to all relevant certification. The marking allows the **origin, standard, inspection history and history of use** to be established at any given time for any given single item.

⛔ **No marking, no use**

If equipment is **not marked and therefore not traceable, it should not be used**.

Suggested serial code scheme

Use a serial code comprising letters and numbers to uniquely identify each individual item. (All Petzl equipment manufactured from 2006 is marked with both batch and individual serial numbers in the factory.)

- Two letters identify the **type** of item — e.g. Chest Ascender: **CA**.
- A number identifies the **item uniquely** — e.g. **001**.

The serial code for this particular item would then be **CA 001**.

For dynamic rope use **DY**; for low stretch rope use **LS**. **Always mark each rope with its length in metres** — at both ends.

How to mark each item

Item	How to mark
Helmet	Mark the serial code on the inside with an indelible pen that will not affect the integrity of the shell.

Item	How to mark
Metal items	Engrave lightly with the serial code in an area clearly visible and in a manner that will not affect function or load-bearing properties.
Webbing	Mark the serial code on the information tag supplied with the item.
Harness	Mark the serial code on the information tag supplied with the harness — or engrave it on the metal attachment point if it has one.
Rope	Wrap suitable marking tape around the circumference at both ends. Write the details with an indelible pen. Cover the tape with clear heat-shrink sleeving.

ⓘ **Petzl date code**

Petzl markings give details on manufacture, control and traceability — e.g. 06237FC0123: **06** the year (2006), **237** the day (237th), **FC** the inspection control, **0123** the unique number.

Equipment examination

Pre-use, periodic and thorough examinations — what to look for in textiles, metal and helmets.

Equipment examination

Equipment examinations play a central role in the IRATA scheme of work. They fall into three categories:

1. **Pre-Use Check** — before each use and continuously during use.
2. **Periodic Examination**.
3. **Thorough Examination**.

> ⛔ **If in doubt, withdraw**
>
> Any item showing signs of defect or alteration without the approval of the manufacturer should be withdrawn from service immediately.

All inspections of PPE must be carried out by personnel who are **trained and competent** to do so. Familiarity with all equipment is essential if deviations from the norm are to be detected.

Manufacturer's lifespan recommendations

Strictly follow manufacturer recommendations on obsolescence. In certain circumstances, the maximum service life could be as little as a **single use**.

- **Petzl metal items** have an **indefinite lifetime**. Removal from service is the responsibility of the competent person carrying out the examination.
- **Petzl textile items** have a **maximum life of 10 years**. Removal from service is the responsibility of the competent person carrying out the examination.

1. Textile equipment

Rope and webbing should be given a **visual and tactile inspection**, both before being placed into storage and before being issued back into service.

For **kernmantel rope**, a tactile inspection should be conducted by physically running the rope through the hands and feeling for any deformities to both the inner core and outer sheath, whilst visually checking the sheath for damage etc.

Webbing equipment should be inspected for:

- ✓ Cuts, nicks, tears.
- ✓ Abrasion.
- ✓ Broken stitches.
- ✓ Chemical contamination.
- ✓ Distortion of the weave pattern (indicating that the product has been subjected to undue loading).

Common causes of damage

- **Abrasion** is the most common cause of strength loss. Often the internal cause (dirt and grit) is the most-overlooked.
- **Mechanical damage** (e.g. crushing from a falling rock) is proportional to severity.
- **Overloading and shock loading** weaken ropes and webbing — items subjected to a high load should be **scrapped immediately**, in such a way that they cannot be returned into service.
- **Chemical damage** is often difficult to detect until disintegration begins — look for **white powdery residues** on the surface or a notable change in texture.
- **Heat damage** — **burnt or glazed** appearance indicates exposure to high temperatures.

ⓘ **Polyester vs nylon**

Polyester has better resistance than nylon to **acids**. Nylon has better resistance than polyester to **alkalis**.

> ⚠ **Temperature**
>
> Most man-made textiles will begin to change in character and therefore performance at temperatures in **excess of 50 °C**.

Cleaning & maintenance

- Wash in clean water at a **maximum of 40 °C**.
- Use pure soap flakes or a mild detergent (pH 5.5–8.5).
- Rinse thoroughly. Bag textiles before machine washing to protect against mechanical damage. **Do not use a high-pressure hose**.
- Dry naturally in a well-aired room away from direct heat or sunlight.
- Textiles in contact with rust should be washed. **Permanent rust marks → scrap.**

2. Metal equipment

Inspect carabiners, Maillon Rapides, ascenders, descenders and harness buckles to ensure mechanical function is not impaired:

- Springs, hinges and threads work smoothly.
- Bolts and rivets are tight.
- No signs of deformation, wear, cracks or other deviations from the norm.

Equipment should be kept clean and dry. Lubricate moving parts (**excluding those that may come into contact with textiles**) with silicon-based lubricants.

> ⛔ **Hidden damage**
>
> Metal equipment can suffer **internal damage** that may be extensive though not visually detectable — often caused by dropping or overloading — and can result in **catastrophic failure without prior warning**.

Cleaning & maintenance

- Submerge in clean hot water (**max. 100 °C**) using a detergent or soap.
- Rinse thoroughly.
- An **abrasive pad or scrubbing brush** may assist — non-metallic (e.g. nylon).

3. Helmets

Check both inside and outside the shell for wear, cracks, burns, deformation and traces of chemical substances. Check the cradle for sound fixing, tears and loose stitching. Verify all adjustable parts are fully operational without slippage and not damaged or worn.

> ⓘ **Some manufacturers**
>
> Some manufacturers recommend a **thorough examination of their helmets every three months**.

Cleaning & maintenance

- Wash with clean water at **maximum 30 °C**.
- Do not use a high-pressure hose.
- Use a soap or powder suitable for delicate fabrics to wash the straps.
- Dry in a cool, dark, well-ventilated place.
- Remove adhesive (e.g. stickers) with methylated spirits.

Eyebolts — types and examination

Eyebolts for rope access, lifting loads and fall arrest — and the different examination regimes that apply.

Eyebolts

The British Standard **'Code of Practice for the Use of Rope Access Methods for Industrial Purposes' (BS 7985)** states that all eye-bolt anchors used for the purpose of rope access should comply with **EN 795**.

1. Eyebolts for rope access

LOLER Regulation 9 requires such eyebolts to be **thoroughly examined by a competent person at least every 6 months** (or at frequencies determined in a written examination scheme drawn up by a competent person).

The competent person has the responsibility to determine whether the thorough examination should include **testing**. In addition, eyebolts should be **inspected before each occasion of use**.

2. Eyebolts for lifting loads other than people

Usage	Classification	Examination
Removable threaded eyebolt **screwed into a load** as an attachment for lifting slings	**Accessory for lifting**	Thoroughly examined **every 6 months** (LOLER Reg 9).
Eyebolt or pad eye **used as an anchor** for supporting lifting equipment (e.g. a winch)	**Lifting equipment**	Thoroughly examined **at least every 12 months** under LOLER.
Pad eye (or link) **permanently fastened** to a load to connect lifting slings	**Part of the load**	Maintained safe (PUWER Reg 5), of adequate strength (LOLER Reg 4), pre-use check (LOLER Reg 8).

> ⚠ **Absolute duty under PUWER**
>
> In all the above cases there is an **absolute duty under PUWER** to maintain eyebolts, pad-eyes and links in a safe condition.

3. Eyebolts for fall arrest

An eyebolt which acts as an anchor for a fall-arrest lanyard is **not a lifting accessory** and does not require examination under LOLER. Instead, it is considered part of the fabric of the building/structure and comes under the **Workplace (Health, Safety & Welfare) Regulations 1992**.

EN 795 requires examination at least every **12 months** by a competent person. Examination after installation and at regular intervals subsequently is also likely to be necessary to comply with the general requirements of the Health and Safety at Work etc. Act 1974.

A competent person should carry out the examination in accordance with the guidance and recommendations given in **EN 795** and **BS EN 7883**.

IRATA technicians' responsibilities under LOLER

The inspection competencies expected at each IRATA level.

IRATA technicians' responsibilities under LOLER

IRATA technicians have a number of responsibilities under LOLER for inspecting equipment, depending on their level of competence.

Level 1 Technician

1. Be able to carry out a **pre-use check** of all their personal suspension equipment.
2. Be able to identify defective or worn items of personal suspension equipment and describe the reasons for failure.
3. Understand key requirements of LOLER, including:
    - Rope access operations should be planned and managed.
    - Equipment should be used safely.
    - Equipment should be identified and examined regularly.
    - Understand the principles of certification and traceability.

Level 2 Technician

1. As Level 1.
2. Identify proper maintenance measures.
3. Be able to carry out **periodic inspection** of items (e.g. long-term rigging).
4. Know how to complete records of periodic inspections (and understand the need for keeping those records).
5. Understand the consequences of not reporting defects or situations posing a risk to health and safety.

Level 3 Technician

1. As Level 2.
2. Be able to produce an **examination scheme** for any given item of lifting equipment.
3. Be able to plan rope access operations.
4. Be aware of factors of safety for metal and textile items.
5. Understand the Safe Working Loads for key items of rope access equipment.
6. Explain the key requirements of the regulations relating to rope access equipment and operations, covering:
    - **Application** — access / egress of the worksite; protection to others; objective hazards.
    - **Equipment strengths**.
    - **Positioning** — especially in relation to other work tasks.
    - **Equipment marking** — be able to identify proper position and method; understanding of SWL of 1 person for PPE.
    - **Organising of operations** — adequate theoretical and practical knowledge in relation to load attachment, work environment and hazards.
    - **Thorough examination and inspection of equipment**.
    - **Reporting defects** — the need for good record keeping.
7. Understand the strength and properties required of anchorages suitable for use in rope access operations.
8. Be aware of the relationship of LOLER with other key legislation.

Storage, quarantine, reporting & disposal

Keeping fit-for-use kit separate from defective kit, and how to dispose of equipment when it's retired.

Equipment storage, quarantine & disposal

Storage

Equipment should be stored in a **secure environment** to which access is restricted to necessary, competent personnel only.

After the equipment has been cleaned, dried, serviced and inspected according to the manufacturer's 'User Information', it should be stored in a **dry, well-aired environment** away from:

- Direct sunlight.
- Other sources of excessive heat.
- Any chemical contaminants.

When on-site, ropes and other items should be stored loose in equipment tackle sacks in a safe, secure place — to reduce the risk of chemical attack or mechanical damage.

Coiling ropes

Where ropes are required to be coiled, consider:

- The **size and manageability** of the coil.
- Whether it needs to be **coiled double** with anchor-point knots pre-tied to allow easy installation during an aid climb, for example.
- The coiling method should not **twist** the rope or be prone to tangling during uncoiling.

A standard 50 m dynamic rope, pre-coiled and secured with straps by the manufacturer, will require **two operatives** to uncoil it if tangles are to be avoided. Where rope is to be removed directly from the drum, it will first require securing — then unroll into a heap on a protective pad. Once cut and marked, coil in the manner appropriate to the operations taking place.

> ⚠ **Tangles in a rescue**
>
> Consideration should be given to the problems associated with tangled ropes, particularly **during rescue operations when time is of the essence**.

Quarantine procedures

A quarantine procedure ensures that:

- **New equipment** does not enter service without first being inspected, marked and the details entered into the relevant logs.
- **Defective or suspect equipment**, which has been withdrawn, does not enter service again without the inspection or approval of a competent person.
- **Equipment awaiting disposal** cannot re-enter service.
- **Equipment returned from operations** does not re-enter service without first being inspected.

Achieve this with a secure area marked **'Quarantine'** where equipment in the above categories can be kept separately. When an item enters quarantine it should be inspected by a competent person and a secure label attached stating the reason — e.g.:

> *“Quarantine — Awaiting inspection, returned from site.”*

Reporting lost or defective equipment

The law requires that:

1. **Employers** make arrangements to ensure employees can report any lost or defective PPE.
2. **Employees** report any loss, damage or deficiency.

These arrangements should ensure that defective PPE is **replaced before the employee concerned begins work again**.

Disposal

All equipment withdrawn from service should be disposed of by a suitably competent person, with the course of action entered into all relevant logs.

- **Textiles** should have the serial codes removed and be **cut up into unusable lengths** before disposal.
- **Metal items** should be **recognisably and mechanically dysfunctional** before disposal.

⛔ **No return to service**

Once it has been decided that an item is to be withdrawn from service, steps should be taken to ensure there is **no possibility of that equipment being used from that point onwards**.

CAPÍTULOS · 06

Knots

The core knots used in rope access, their applications, strength loss and how to dress and set them.

Knots

A knot in a rope reduces its strength — typically by **30–35%** for the figure-of-eight family. A bowline loses more (40–47%) and **must always be secured with a half hitch**.

⛔ **Dress and set**

Always ensure knots are **correctly dressed and set** before use. A poorly dressed knot can slip or fail at loads well below its rated strength.

⚠ **No overhand knots on ends**

Overhand knots should **not** be used on the ends of ropes due to the possibility of slippage.

Practice each knot under the supervision of your instructor until you can tie it cleanly, dress it and inspect it for correctness without hesitation.

Double figure of 8 on the bight (Bunny)

Used to link and equalise two anchors.

Double figure of 8 on the bight ("Bunny")

Use: to link and equalise **two anchors**.

Strength loss: approximately **30–35%**.

After adjustment the **'common loop'** should be positioned at the top of the three loops.

> ⓘ **Dressing**
>
> Always ensure knots are correctly dressed and set before use.

Figure of 8 on the bight

A loop in the end of a rope, used as a main anchor point.

Figure of 8 on the bight

Use: to form a loop in the end of a rope as a **main anchor point**.

Strength loss: approximately **30–35%**.

Always ensure knots are correctly dressed and set before use.

Figure of 9 on the bight

Like a Fig. 8 but easier to untie after loading.

Figure of 9 on the bight

Use: to form a loop in the end of a rope as a main anchor point.

Why use it over a Fig. 8? Easier to untie than a Figure of Eight on the Bight **after loading**.

Strength loss: approximately **30–35%**.

Always ensure knots are correctly dressed and set before use.

Re-threaded figure of 8

For tying directly into the harness or around tubular steelwork.

Re-threaded figure of 8

Use: for tying directly into the harness in a **lead climbing** situation, or around **tubular steelwork**.

Strength loss: approximately **30–35%**.

Always ensure knots are correctly dressed and set before use.

> ⓘ **Variant for cow's tails**
>
> The same technique can be used for re-threading **2 × overhand knots** for tying a 4 m long cow's tail directly into the harness attachment ring — giving **2 × long** and **1 × double-length short** cow's tails. Your instructor will demonstrate the tying method and discuss the advantages.

Bowline

An alternative for tying into the harness or around steelwork — must always be backed up.

Bowline

Use: for tying directly into the harness in a lead climbing situation or around tubular steelwork.

> ⛔ **ALWAYS back it up**
> This knot should **ALWAYS** be secured with a **half hitch**.

Strength loss: approximately **40–47%**.

Always ensure knots are correctly dressed and set before use.

Alpine butterfly

A mid-rope knot suitable for multi-directional loading.

Alpine butterfly

Use: a mid-rope knot suitable for **multi-directional loading**. Ideal for **long Y-hangs** and as a **temporary mid-rope knot**.

Strength loss: approximately **30–35%**.

Always ensure knots are correctly dressed and set before use.

Scaffold knot (½ Double Fisherman)

Stopper knot in the end of a rope; with a loop it's the best cow's tail knot.

Scaffold knot (½ Double Fisherman)

The **Scaffold Knot** is often incorrectly referred to as a Barrel Knot.

> ⓘ **Strongly recommended for cow's tails**
>
> Strongly recommended for the **ends of cow's tails**, due to its excellent dynamic capabilities.

Use:

- As a **stopper knot** in the end of a rope.
- When tied **with a loop** it forms the best cow's tail knot in terms of reducing **Peak Impact Force (PIF)**.

Strength loss: approximately **30–35%**.

Always ensure knots are correctly dressed and set before use.

Double Fisherman

Join two ropes of equal diameter.

Double Fisherman

Use: to join **two ropes of equal diameter**.

Strength loss: approximately **30–35%**.

Always ensure knots are correctly dressed and set before use.

CAPÍTULOS · 07

Rigging

Two-rope security, Y-hangs, deviations, re-anchors, rope protection and choosing anchors.

Rigging

All persons using industrial rope access techniques (i.e. where rope is used as the **primary means of support or positioning**) must be attached to **two independently attached ropes**. These should be arranged so that in the event of a failure in one, the operative is protected by the remaining rope and cannot suffer a fall.

In practice, one of these ropes will be used as a **primary suspension (working) rope** and the other a **safety (back-up) rope**. Each rope should have its own separate anchor system.

> ⛔ **Cascading failure**
>
> Ropes should be rigged so that if one should fail, **a shock load would not be passed on through the system** — for example, to the operative, the remaining rope, or the anchor.

- **No potential fall should cause the operator to impact the ground.**
- All practicable measures should be taken to avoid injurious impact with the structure or other obstructions.

Wind

The adverse effects of high winds should be removed by:

- Only working on the **lee side** of a structure.
- Fixing **tensioned guide lines**.
- Installing **deviations** at regular intervals to keep the ropes in place.
- Or simply **not working** in such conditions.

Y-hangs

Sharing the load between two anchors — and the angle limit that matters.

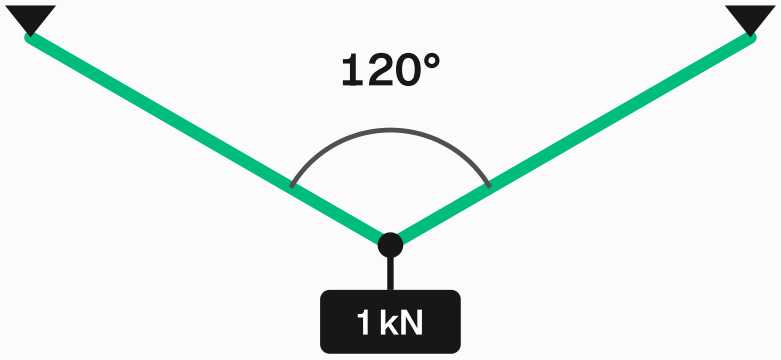
Y-hangs

A **Y-hang** is achieved by rigging both ropes so that each is attached to, and shares the load between, **both anchor points**. When the ropes are weighted, the load should be evenly distributed between both anchors.

120° Y-hang — each anchor sees the full 1 kN load. Never exceed this angle.

The angle of the Y is everything

Drag the slider to see how the force on each anchor changes with the angle of the Y. The rope colour tracks the IRATA safety bands.



Snapshot at 120° internal angle

PER-ANCHOR FORCE VS. INTERNAL ANGLE (1 KN LOAD)

Angle	Per anchor (kN)	Multiplier (×)	Band
0°	0.50	0.50×	Safe
30°	0.52	0.52×	Safe
60°	0.58	0.58×	Safe
90°	0.71	0.71×	Safe
120°	1.00	1.00×	Safe
130°	1.18	1.18×	Caution
150°	1.93	1.93×	Caution
160°	2.88	2.88×	Caution
170°	5.74	5.74×	Exceeds WLL

Formula: per-anchor force = (load/2)/cos(angle/2). Thresholds: ≤120° safe, ≤160° caution, >160° exceeds WLL.

Numeric reference table ▲

Angle	Load on each anchor (with 100 kg load)
0°	50 kg
60°	57 kg
90°	71 kg
120°	**100 kg**
140°	146 kg
150°	193 kg
160°	288 kg
161°	303 kg
177°	1915 kg
178°	2873 kg
179°	5747 kg

⛔ **The 120° rule**

It is essential that rigging angles **should never exceed 120°**, at which point the load placed on the rope is equal to the load placed on **both** anchor points. Ideally an angle **not exceeding 90°** should be achieved.

⚠ **At 160° you're at the WLL of the rope**

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

The formula

```
Load at each anchor = (L ÷ 2) ÷ cos(½ A)
```

Where **L** is the load and **A** is the angle of the Y.

Worked example for A = 120° and L = 100 kg:

> *“Anchor Load = (100 ÷ 2) ÷ cos 60° = 50 ÷ 0.5 = **100 kg**.”*

Failure-of-one-anchor swing

Where the anchor points for a Y-hang are located a reasonable distance apart, consider the effects of the failure of one of the anchors (e.g. a swing likely to cause personal injury).

> ⓘ **Doubling up**
>
> This potential problem can be lessened by using **2 anchors for each half of the Y**, thereby preventing a swing should any one element of the system fail.

Deviations — single & double

Redirecting ropes around hazards, and the deflection angle that drives loading.

Deviations

A **deviation** redirects the path of the ropes from the anchor points to either:

- Avoid a hazard or abrasion of the ropes (and other potential causes of damage), or
- Provide more accurate access for the operative.

Deviation anchors should be **full-strength slings or rope** anchored to the structure.

Single deviation

A single deviation is used to position the technician — where the consequence of anchor failure would be a **small swing which has no potential for injury or rigging damage**.

> ⚠ **20° maximum**
>
> A single deviation should **not exceed 20° from the vertical** and consists of **one rated anchor**.

Double-anchor deviation

Used to deviate the ropes by a **greater angle and distance** than a single anchor deviation, and/or to protect against more serious hazards such as a sharp edge, hot pipe, or a large swing into a structure.

A double-anchor deviation uses a **double rated anchor system** — two suitably rated anchors and connection components — to provide protection against failure of any one item.

> ⓘ **Consider a re-anchor instead**

Where a large angle is created, users should consider whether a **re-anchor** may be more appropriate.

Rigging a deviation

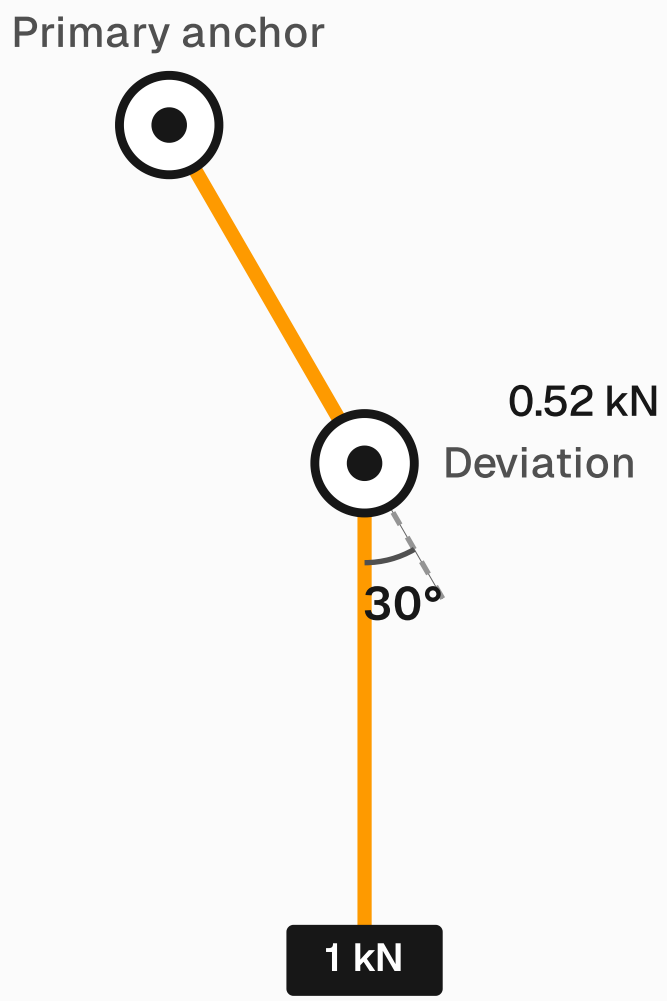
A deviation may be a sling, strop or rope attached to the deviation anchor, then attached to the ropes via carabiners pulling them to one side. Single deviations should not pull the ropes such a distance that, in the event of failure of the single deviation anchor point, a swing likely to cause personal injury, damage to property or abrasion could occur.

⚠ **Always risk-assess**

An assessment of the risks associated with the failure of a deviation should be carried out **prior to the rigging and subsequent use**.

Effect of angle on loading

Drag the slider to see how the force on the deviation anchor changes with the deflection angle. The rope colour and recommendation track the IRATA hierarchy — single, double-anchor, or step up to a re-anchor.



Snapshot at 30° deflection

ANCHOR FORCE VS. DEFLECTION (1 KN LOAD)

Angle	Anchor force (kN)	Multiplier (×)	Band
0°	0.00	0.00×	Single deviation OK
15°	0.26	0.26×	Single deviation OK
20°	0.35	0.35×	Single deviation OK
30°	0.52	0.52×	Use a double-anchor deviation
45°	0.77	0.77×	Use a double-anchor deviation
60°	1.00	1.00×	Use a double-anchor deviation
75°	1.22	1.22×	Consider a re-anchor
90°	1.41	1.41×	Consider a re-anchor

Formula: anchor force = 2 · sin(θ⁄2) × load. Thresholds: ≤20° single deviation, ≤60° double-anchor deviation, >60° re-anchor.

Numeric reference table ▲

Deflection from vertical	Anchor load (with 100 kg load)
0°	minimal
20°	34 kg
45°	70 kg
60°	100 kg
75°	122 kg
90°	141 kg

The formula

```
Anchor force = 2 × L × sin(½ θ)
```

Where **L** is the suspended load and **θ** is the total deflection angle between the rope above and below the deviation. Both rope segments carry tension **L**; the anchor takes the vector sum.

Rope protection — Remove, Avoid, Protect

The hierarchy for protecting ropes against hazardous surfaces (IRATA ICOP Annex P).

Rope protection

The IRATA ICOP Annex P sets out a clear hierarchy for the protection of anchor lines against hazardous surfaces:

> *"**Remove** (the hazard, where feasible) → **Avoid** (the hazard, with re-anchors or deviations) → **Protect** (against the hazard with rope protection measures)."*

⛔ **The biggest danger to a rope**

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**.

Pre-work planning

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.

- Scrutinise the intended path of the ropes in detail from **top to bottom**.
- Consider sideways/lateral movement of the ropes during operations.

When edges can't be avoided

Where possible, every effort should be made to use rigging solutions to keep the ropes away from sharp or hot surfaces — Y-hangs, deviations and re-belays. Additional rope protection may still be required to protect against sideways/lateral movements.

Where it is not possible to avoid contact with hazardous edges, effective rope protection must be deployed.

> ⚠ **Canvas protectors are not always enough**
>
> Canvas **"rope protectors"**, despite their name, are often **not sufficient by themselves** to offer adequate protection from aggressively sharp or abrasive surfaces. Additional measures must be deployed to ensure unquestionably reliable protection to the ropes.

Sufficient protection

In order to offer sufficient protection, the surface or edge should be increased to **greater than 5 mm** 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**.

> ⚠ **Avoid prussiks for protectors**
>
> Prussik knots, although commonly used to attach rope protectors, are subject to interference. A non-expert technician is at risk of not re-installing the protection properly — resulting in the protector detaching and falling down the rope, 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 — but always in addition to suitable and sufficient edge padding.

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

Rope security — stopper knots

All ropes, whether reaching ground level or not, should have a **stopper knot** tied at a suitable point to:

- Prevent the operative from accidentally **descending off the end** of the rope.
- **Bunch the sheath** of the rope up against the knot in the event of serious shock loading with an ascender — this might prevent the operative falling all the way to the floor.

It is important **not to have excess rope coiled on the floor**.

Anchors

Choosing reliable anchors, the 15 kN minimum, and tensioned-line considerations.

Anchors — general

All anchor points used in rope access should be **unquestionably reliable** and capable of withstanding any potential loads.

Examples of suitable anchor points

- **Structural steelwork** with a Minimum Breaking Strength (MBS) of **15 kN** in the direction it would be loaded in normal use.
- Suitably tested **mechanical and chemical anchors**.
- Concrete features.
- Substantial geological features.
- Large trees.
- Cradle rails proven to hold a **6 kN force for 15 seconds between fixing posts**.

Strength requirement

The strength of all anchor systems (**except intermediate deviation anchors**, which may be weaker) should be at least as great as that of the ropes attached to them.

⛔ **BS 7985 minimum**

BS 7985 requires this strength to be not less than 15 kN.

Tensioned anchor lines

When anchor lines are tensioned — for example, when creating a horizontal or diagonal tensioned line — the **increase in forces** at the anchor points and other components in the system should be taken into account and **calculated by a competent person**.

Mechanical & chemical anchor bolts

Bolt anchor installation, testing and the rules in BS 7985 / BS EN 7883.

Mechanical & chemical anchor bolts

Rope access bolt anchors must comply with **EN 795**, and the substrate must be proven to withstand a **12 kN force applied to a sample area of 0.6 m²** over a period of **3 minutes** in the direction it would be applied in service.

Installation should be in accordance with **BS EN 7883**.

Minimum anchor strength

BS 7985 requires anchorages to have a minimum strength of **15 kN**.

For eyebolts or other types of temporary anchors, this minimum may be obtained by **linking and equally loading two EN 795 anchors** with suitable knots (e.g. a Y-hang).

For aid climbing bolt anchors, a suitably competent person should ensure that the structure is engineered to be able to withstand a force of **15 kN** in the direction it would be loaded in normal use.

Types

Three main fixing types exist — selection depends on the substrate:

- **Mechanical** (expansion).
- **Chemical** (resin).
- **Bolt-through.**

A resin anchor should be used if it was considered the expanding action of a mechanical anchor might fracture the host material.

Reusable holes

A sleeve-type resin or expansion anchor can be left in the hole, the hanger plate removed and the hole capped. The anchor can then be subsequently re-used on return visits by uncapping the hole, replacing the hanger plate and re-testing to the required load.

Good-practice installation rules

- ✓ Anchor bolts for rope access must **always be used in pairs**.
- ✓ The host substrate should be carefully checked for **cracks and other weaknesses**.
- ✓ The correct anchor type must be selected for the substrate material.
- ✓ Pairs of bolts should be aligned correctly in relation to the intended load direction.
- ✓ Holes should be drilled **at 90° to the surface** and to the correct depth using the depth gauge on the drill.
- ✓ Hole diameter is dependent on bolt diameter and fixing type.
- ✓ The **minimum distance between 12 mm bolts should be 150 mm** if full strength is to be retained. (Some manufacturers allow closer placement under strict criteria.)
- ✓ Clean holes with a suitable hole brush and blow out — **especially important for chemical anchors**.
- ✓ Expansion bolts should be **torqued** to the value specified by the manufacturer.
- ✓ Resin anchors should be given time to **cure** — which may be temperature-sensitive.
- ✓ The bolt head or hanger should sit **flush with the surface**.

⛔ **Pre-use pull test**

Before use, an outward (axial) **pull test of 6 kN must be applied for 15 seconds** to all anchor bolts placed in brick, concrete or stone to confirm the soundness of the fixing.

Ground, dead-weight, beam clamps & roof structures

Anchorages used when conventional structural anchors aren't available.

Other anchor systems

Ground anchors

The operative may be required to operate in an area where no anchor points are readily available. In these cases it may be possible to:

- Utilise suitable **ground-driven anchors**.
- Attach to suitable points on a **motor vehicle** (that has been effectively isolated and rendered immovable), with ropes going up and over the building.

> ⓘ **Documented procedure**
>
> Companies carrying out this type of work will have their own **documented procedures** for these anchorages.

Dead-weight anchors

Where no anchor points are available on the roof, dead-weight anchors may be used.

Particular account should be taken of **cantilever** and **frictional** effects. Wet or icy conditions can significantly affect frictional performance.

The frictional resistance of any anchor weight should be assured by checking that it does not move when subjected to a load of **4× that which could be applied in a work positioning situation**. In a rescue the system may have the weight of **two persons** applied — consider the effect of a main rope failure during a rescue.

Also consider the **stretch potential** in the rope and unusual abrasion points. Always refer to the manufacturer's instructions before using these anchor systems.

⛔ **Parapet wall frames**

Counterweighted lifting support beams such as **parapet wall frames** are designed with a Factor of Safety of **3:1**. Such systems often fall **well short** of the minimum anchor-strength requirements of BS 7985. **They should be used with great caution.**

Beam clamps

Beam clamps can provide a simple and portable attachment point.

⚠ **Only on rated beams**

They should **not** be used on any beam other than those designed, tested and marked as a **runway beam** (or lifting beam) — with the exception that they may be used on a beam forming part of a structure where a specific design check for this purpose has been made.

Refer to the user information supplied with the product.

Using roof buildings & structures as anchorages

It is often possible to anchor ropes inside or around a sub-building situated on the roof, with the ropes radiating out to the required points on the roof edge.

- All textiles used for rigging must be suitably protected against abrasion and cutting.
- Where the anchor itself may cause damage to rope or textile slings, use canvas rope protectors or install wire slings.

Steel cables around sub-buildings

The most common method is to utilise **two 12 mm steel cables**.

- Protect at the corners of the roof building to ensure damage doesn't occur to either the cable or the building.
- Follow your company's **own written procedures** for fixing methods.

- **Bulldog clips should be attached with the saddle on the 'Live' end** of the cable.

Using structural steel

Where structural steel members are to be used as anchorages, it is imperative they are **soundly attached** to the building roof or walls.

- Check all necessary fixings are in place and tight.
- It would be advisable to use steel attached by **nuts and bolts** — welded fixings may require **Non Destructive Testing (NDT)** prior to use.

> ⚠ **Plan for failure**
>
> At all stages of rigging, personnel should take into account the consequences should any part of the system fail.

CAPÍTULOS · 08

Rope access manoeuvres

Pre-use checks, safe access to the ropes, ascending and descending, changeovers, transfers and passing obstacles.

Rope access manoeuvres

Before any work is carried out, ensure that the level of supervision is appropriate to the work situation — both in the **numbers of operatives being supervised** and the **skill levels** of the operatives being appropriate for the tasks.

Supervision

- The supervisor's role is to ensure that all work is carried out in accordance with the method statement, to ensure **no accidents, no wastage of materials and no defects** in the work being carried out.
- Operatives who have had a significant break from rope access work should undergo **refresher training** at the appropriate level prior to commencement.
- Newly qualified operatives should be subject to **close supervision** until deemed competent.
- Worksites with more than one discrete working area must have appropriate supervision in each — generally **no more than 4 operatives per 1 supervisor**.

> ⓘ **Team size**
> Work teams should be **no smaller than two operatives**, including a competent supervisor.

On larger sites where communication is a problem, consider the provision of two-way radios and their correct use. **Permission should be sought from the site manager before radios are used.**

Pre-use checks & safe access to the ropes

What to check before leaving the safe ground, and how to handle the danger zone.

Pre-use checks & safe access to the ropes

Pre-use check

All suspension equipment needs to be checked **prior to each use**. Level 1 technicians should have their equipment inspected by the **Level 3 Safety Supervisor** or his nominated person.

⛔ **Stopper knots before rope manoeuvres**

Before any rope manoeuvres are carried out, ensure that there is a **security knot tied in the lower ends of both working and back-up ropes**.

Safe access to & from the ropes

- Where possible, the operative will attach or detach from both safety and working ropes **2 m away from unprotected edges** where there is no risk of falling.
- If this cannot be achieved, **cow's tails, lanyards or other suitable equipment** must be used to protect the operative whilst in the danger zone between safe ground and the ropes.
- If there is a risk of falling a distance likely to cause personal injury, a **fall arrest harness and energy-absorbing lanyard** should be used.

Descending

Setting up, going over the edge, controlling the descent and releasing a loaded back-up.

Descending

- If safe access to the ropes is not available, protection needs to be maintained by other means until the operative is secured on both ropes.
- At the top of the rope drop, **first attach the back-up device, then the descender** to their respective ropes.

> ⚠ **Mind the stretch**
>
> Attention must be paid to any large distance between the anchors and the point where you attach your descender. The rope may stretch once a load is placed on it. If sufficient measures have not been taken, the operative may drop, stressing the anchor points and placing the operative in a situation where they have no control.

Locking off & moving over the edge

- Lock off the descender so that when the working rope is under tension it will overcome the edge of the drop and sit **within 0.3 m of the top** of the drop.
- The correct procedure for locking off a descender will be shown by your instructor and found in the information leaflet supplied with the device.
- Move the safety back-up device on the back-up rope to a position which **minimises any falling distance**.
- Move over the edge in a controlled manner until your weight is transferred to the working rope.
- Check that all equipment is loaded correctly and that it is safe to descend.

The descent itself

⛔ **Hand position**

Unlock the descender device and descend. The **right (controlling) hand should always maintain a firm grip on the rope approx. 500 mm below the descender device** throughout the descent.

- Ensure the back-up device travels freely down the rope as you descend.
- The controlling arm should be tucked into the body and the controlling hand positioned approx. 500 mm below the descender — allowing the device to be safely locked off if damage to the rope sheath is discovered during the descent.
- If you need to stop and use both hands for a work task, ensure your descender is first locked off.
- Once locked off, position the back-up device **high up** on the safety rope to minimise both the falling distance and the shock load to the system should the working rope fail.

ⓘ **Lose control? Let go**

If you lose control of the descent at any time, **let go of all equipment**. The descender device will then lock onto the working rope and/or the back-up device will lock onto the safety back-up rope.

Releasing a loaded back-up

To release a back-up device that has become loaded onto the safety rope:

1. First ensure the descender device is securely locked off.
2. Attach a handled ascender to the safety rope, a good distance below the back-up device.
3. Stand in the foot loop — the stretch in the back-up rope will generally allow you to de-weight the back-up device.

If this is not possible, follow the **"De-Weighting a Loaded Safety Rope during a Rescue"** procedure.

Ascending

Chest ascender, handled ascender and foot loop — the basic ascent cycle.

Ascending

1. First attach the **back-up device** to the safety rope.
2. Attach the **chest ascender** to the working rope.
3. Attach the **handled ascender** and **foot loop** to the working rope **above** the chest ascender.

> ⚠ **Always cow's-tail the handled ascender**
>
> A cow's tail should be attached to the handled ascender whenever it is removed from the working rope — to ensure that it cannot be dropped and thus cause a hazard for people working below, and to avoid making the removal of a loaded chest ascender difficult.

The cycle

1. Stand in the foot loop so that the handled ascender is weighted and the working rope will ride through the chest ascender. If the rope drags through the chest ascender, hold the rope coming out of the bottom in your hand or grip it between your feet. Sit back and rest on the chest ascender again.
2. Lift your feet and move the handled ascender further up the rope.
3. Repeat by standing up in the foot loop attached to the handled ascender.

> ⓘ **If you struggle**
>
> Your instructor will demonstrate a number of methods if you struggle with the one mentioned above.

Back-up device position

The back-up device should be kept **as high as possible (in all cases above waist height)** on the safety rope throughout the ascent — to help minimise the fall distance should the working rope fail.

The technique used for moving the back-up device should not affect the operation of the device.

Changeovers — ascent to descent & back

Switching modes mid-rope safely.

Changeovers

Changing from ascent to descent

1. Place the back-up device high up on the safety rope.
2. Attach the descender device onto the working rope, **directly below the chest ascender**.
3. Take in any slack rope through the descender until approximately **50 mm** remains between the descender and the chest ascender.
4. Lock off the descender.
5. Move the back-up device to a position **just above waist height**.
6. Position the handled ascender at head height so that when standing in the foot loop, weight will just be taken from the chest ascender.
7. Stand up in the foot loop whilst disengaging the chest ascender, and then sit back onto the descender, which will then become weighted.
8. Remove the handled ascender and foot loop from the working rope and begin to descend.

Changing from descent to ascent

1. Stop the descent. Lock off the descender and position the back-up device high up on the safety rope.
2. Attach the handled ascender to the working rope **above the descender**, leaving room between the two to allow attachment of the chest ascender.
3. In one movement: stand up in the foot loop, locate the chest ascender onto the working rope, close the cam, and sit back onto the chest ascender.

4. Remove the descender from the working rope and begin to ascend.

Rope-to-rope transfer

Moving between two pairs of ropes safely, maintaining two-point security throughout.

Rope-to-rope transfer

Before attempting any rope-to-rope transfer, ensure you are in **descent mode**.

1. Lock off the descender and position the back-up device high up on the safety rope.
2. Take hold of the new working rope and attach **both ascenders** to it, taking care to pull through all slack rope so that the chest ascender is in tension.
3. Place a **secondary back-up device** on the second back-up rope.
4. **Descend the original working and safety ropes** until the weight is transferred to the new ropes.
5. Remove the descender and back-up device.
6. Place the back-up device on the new safety rope **above the knot**, remove the cow's tail and untie the knot.

Passing knots

Crossing a knot mid-rope in both ascent and descent modes.

Passing knots (ascent & descent mode)

Descent — knot in working rope

1. Descend until the knot is approx. **50 mm from the entry point** into the descender device. This effectively locks the descender. Ensure the back-up device is high up on the safety rope.
2. Attach the **handled ascender** to the working rope above the descender. Stand in the foot loop and attach the **chest ascender** above the descender.
3. Remove the descender and replace it on the working rope **below the knot**. Lock off the descender.
4. Progress downwards on the ascenders (**reverse prussik**), moving the back-up device down as you descend, until the chest ascender is just above the knot.
5. Standing in the foot loop, remove the chest ascender and sit back on the descender.
6. Remove the handled ascender and continue to descend.

Descent — knot in safety rope

1. Descend until just below the knot and lock off the descender.
2. Attach **2nd back-up high above** the knot.
3. Remove the original back-up device and re-attach it **below the knot**.
4. Remove the 2nd back-up, unlock the descender and continue to descend.

Ascent — knot in safety rope

Carry out the descent (knot in safety rope) procedure **in reverse**.

Ascent — knot in working rope

1. Ascend the ropes until just below the knot, ensuring the back-up device is placed high up on the safety rope.
2. Remove the handled ascender and replace it on the working rope **above the knot**.
3. Step up a little to bring the chest ascender to just below the knot, and attach the descender below the knot.
4. In one movement, stand up in the foot loop, remove the chest ascender and replace it above the knot.
5. Remove the cow's tail from the loop of the knot and continue to ascend.

Passing deviations & re-anchors

Single and double deviations, plus how to handle re-anchors.

Passing deviations & re-anchors

Where the direction of the ropes needs to be changed slightly — either to avoid abrasion or to afford the technician more efficient access — a deviation is installed.

Single deviation

Ascent

1. Ascend until level with the deviation anchor point.
2. Place the ropes below your chest ascender and back-up device into the **spare carabiner** of the deviation.
3. Once in place, pull yourself into the deviation anchor point sufficiently to remove the original deviation carabiner, and gently lower out using the trailing ropes below.
4. Continue with the ascent.

Descent

Carry out the above operation in reverse.

Double deviations

> ⓘ **Variations**
>
> There is a variety of methods to pass a double deviation and your instructor will demonstrate the methods that are acceptable.

⛔ **Double protection**

Always utilise **double protection** when passing a double deviation.

Passing re-anchors

Where the direction of the ropes needs to be changed and it is not practicable to use a deviation either to avoid abrasion or to afford the operative more efficient access, a **re-anchor** should be installed — a double anchor point part-way down the drop into which the ropes are originally knotted and attached.

This manoeuvre can be treated as a **rope-to-rope transfer** in both ascent and descent. Your instructor will demonstrate.

Pull-through

Installing and retrieving ropes from a position where direct access to the belay isn't possible.

Pull-through

This technique should be used **only if there are no other means** of carrying out the task.

Descending & de-rigging

1. Both the working and back-up ropes should be passed around the structure — **ensuring both ends of each rope have a security knot and they reach the floor**.
2. Tie a knot on one side of each rope (Alpine Butterfly or similar) just below the structure and connect carabiners to the loops created.
3. Clip these carabiners to the ropes hanging on the **opposite side** of the structure and pull tight.
4. First attach your back-up device and then your descender to the live ropes and descend.
5. Upon reaching ground level, remove all equipment and any knots. Pull the ropes down.

Ascending & rigging

1. Throw a thin line over the structure.
2. Attach the working and safety ropes to the line.
3. Tie the appropriate knots at the **half-way point**.
4. Attach carabiners in the manner shown to you.
5. Pull the ropes until they are in the final position.

The risks

⛔ **Use sparingly**

The pull-through method has a higher level of risk attached due to possible **abrasion problems on the hidden side of the structure** and the possible mistake of attaching to the **wrong side of the rope** with disastrous consequences.

⚠ **Competent technicians only**

This method should be restricted to **competent and experienced technicians only**, used as a once-only method of access to or egress from the worksite, and then immediately re-rigged in an appropriate manner.

Dependent on the shape of the structure, it is possible that the connector could be **abnormally loaded** during use. Consider the use of appropriate **Maillon Rapide** connectors in such circumstances.

Horizontal & vertical aid climbing

Making progress along or up a structure using anchor points or wire slings.

Aid climbing

Horizontal aid climbing

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

Three cow's tails will be required (two long and one short), so as to maintain **two independent points of attachment** whilst re-positioning a third.

From the top of a set of ropes

1. Ascend the ropes stopping just below the aid route.
2. Remove the top (handled) ascender and attach its cow's tail directly into the anchor point carabiner — this is the **trailing cow's tail**.
3. Remove the back-up device and attach its cow's tail to the first free anchor point carabiner. Attach an etrier to this cow's tail — the **leading cow's tail**.
4. Stand in the foot loop and etrier, remove the chest ascender and attach the **short cow's tail** to the same anchor point carabiner as the leading cow's tail.
5. Remove the leading cow's tail and move it forward to the next free anchor point carabiner.
6. Remove the trailing cow's tail and re-attach it to the short cow's tail anchor point carabiner.
7. Stand in the foot loop and etrier and remove the short cow's tail, re-attaching it to the leading cow's tail anchor point carabiner.
8. Repeat the procedure — systematically moving the cow's tails in the direction of travel.

> ⓘ **Hang from the short**
>
> Aim to be suspended from the **short 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.

Along a structure with wire/webbing slings

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

Vertical aid climbing

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

A **double energy-absorbing lanyard** attached to the sternal attachment on the harness, and a **short cow's tail**, will be required — so as to maintain two independent points of attachment whilst re-positioning a third.

> ⚠ **Reduce the fall height**
>
> It is important to ensure that should an anchor point fail, the fall height is reduced to as short a distance as is reasonably practicable.

Your instructor will show you a variety of methods to vertically aid climb. One sequence:

1. Attach short and long cow's tail to first anchor and place second long cow's tail on second anchor.

2. Then move the long cow's tail on the first anchor to create a third anchor above the second.
3. Step up using foot loops and place the short cow's tail into the next anchor point.
4. Repeat.

Horizontal & diagonal tensioned lines

Tensioned traverses, lifelines and the angle-loading effects to plan for.

Tensioned lines

Horizontal lifelines

The main consideration when setting up a horizontal lifeline is the effect of **angle loading** on the system. The load on the lifeline and the anchors may be **up to three times** the load imposed on it.

Drag the sliders to see how span and sag combine into anchor tension — small sag means big force.

Snapshot: 15 m span, 1 m sag, 100 kg load

ANCHOR TENSION VS. SAG (100 KG LOAD)

Scenario	Angle	Mult.	Tension (kN)	Band
15 m span, deep 3 m sag	21.8°	1.3×	1.32	● ≤ 3× — well rigged

Scenario	Angle	Mult.	Tension (kN)	Band
15 m span, 1.5 m sag (10%)	11.3°	2.5×	2.50	● ≤ 3× — well rigged
15 m span, 1.0 m sag	7.6°	3.8×	3.71	● 3–5× — typical IRATA practice
15 m span, tight 0.5 m sag	3.8°	7.5×	7.37	● > 5× — re-rig with more sag
20 m span, very tight	1.7°	16.7×	16.36	● > 5× — re-rig with more sag
Long 30 m line, 0.5 m sag	1.9°	15.0×	14.72	● > 5× — re-rig with more sag

Anchor tension = (load × g) ÷ (2 · sin θ), where θ is the angle from horizontal. Halving the sag roughly doubles the anchor force. Bands: ≤3× well rigged, 3–5× typical practice, >5× re-rig with more sag.

- ✓ Solid anchor points should be selected at each side of the lifeline.
- ✓ Intermediate anchors placed a maximum of 5 m apart.
- ✓ The lifeline should run freely through the intermediate anchors (not knotted).
- ✓ The rope should be hand tensioned through the descender.
- ✓ 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 minimise potential falls.

Horizontal tensioned traverse lines

A horizontal tensioned traverse line will normally comprise **two separate ropes running side by side** in a horizontal plane, each rope separately anchored at both ends.

⛔ **3:1 mechanical advantage maximum**

All tensioned traverse lines should be tensioned with a **maximum 3:1 mechanical advantage** to avoid excessive loadings of the anchor points.

The operative or casualty should have **two attachments** to the ropes and maintain them at all times during the traverse. This can be achieved by attaching a short cow's tail to both ropes and then attaching a long cow's tail into both ropes.

Other equipment may assist movement along the traverse:

- A **back-up device** placed on one rope, trailing behind the operative to help control the descent down the first half of the traverse.
- A **handled ascender** to assist during the second, upward half.

Your instructor will show you these techniques and illustrate their limitations and potential dangers.

> ⚠ **Angle on the loaded line**
>
> When placed under load, the angle of the traverse rope around the load point may exceed 120° with a consequent increased loading on each anchor. The load applied to the anchors can be reduced by ensuring the load is applied to the two ropes in the system equally. The **Level 3 Safety Supervisor** is responsible for the calculations involved in rigging such a system.

Operatives should be aware that **unnecessary dynamic movement** whilst traversing will place additional peak loads on the anchor point and associated connectors — possibly exceeding their designed Working Load Limit (WLL) or Safe Working Load (SWL).

Work restraint capability

These systems may also be used to offer a **Work Restraint** capability. Ensure the system does in fact **prevent** an operative from entering a falling hazard zone. Where such a system is in place, ensure all operatives are familiar with the maximum length of cow's tail / lanyard to be used on the system. It is acceptable to utilise a **single rope** in these situations.

Diagonal tensioned traverse lines

Diagonal tensioned traverse lines **redirect the path of a descent or ascent** from the vertical to a diagonal plane. They are used in addition to the operative's working and safety ropes, or the double-rope systems used for hauling and lowering.

- Similar in construction to horizontal lines — two separate ropes side by side, each separately attached to independent anchors at both ends.

- One end of the traverse ropes can be attached via suitable descender devices to enable the system to be tensioned or slackened.
- If tensioned, the **angles created when loaded** should be considered (deflection will be small and a high load will be exerted on the anchors).

Use as work positioning

The operative should descend or ascend their ropes in the normal way, whilst having two extra attachments to both traverse ropes. Rope can be taken in and out through the rope adjustment devices at any point during the ascent or descent — enabling the operative's position to be altered in both vertical and horizontal planes.

Use for rescue

The same system of double security should be employed — the casualty should be lowered on two independent systems whilst maintaining two attachments to the tensioned traverse lines.

CAPÍTULOS · 09

Fall arrest

Choosing fall arrest equipment, calculating clearance distances, fall factors and the risk of suspension trauma.

Fall arrest

If the planned method of work is such that should the user lose controlled physical contact with the working surface there will be a **free fall**, it will be necessary to choose fall arrest equipment.

This will include:

- A **full-body harness** that meets the requirements of **EN 361**.
- An **energy absorber** conforming to **EN 355**.
- A **double lanyard system** to allow forward progression without disconnecting from the structure. The lanyards should conform to **EN 354**.

> ⚠ **Last resort**
>
> Following the hierarchy of hazard management, this method of working should only be employed when it is deemed **not reasonably practicable to use any other method** of gaining access.

Clearance distances & golden rules

The 6 m clearance for a 2 m lanyard, plus the do's and don'ts of using fall arrest kit.

Clearance distances

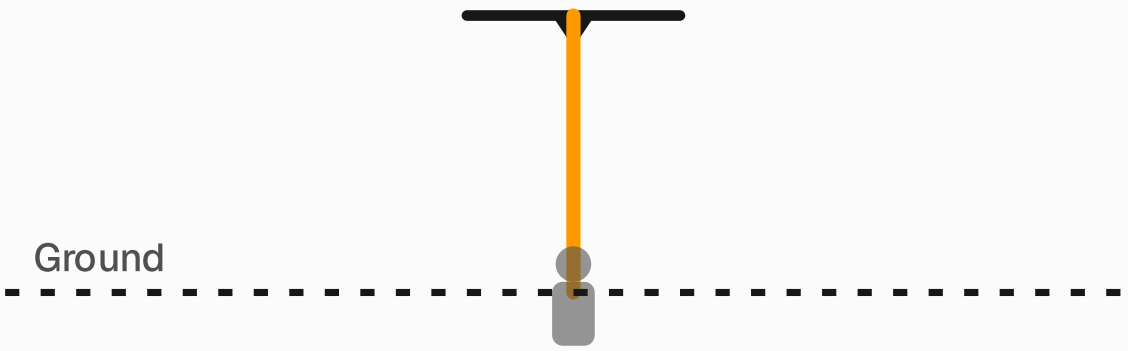
⛔ **Clearance below the work area**

Always ensure there is sufficient clearance distance below the work area to allow for the **length of the lanyard, deployment length and a suitable safety factor**.

For a typical **2 m energy-absorbing lanyard**, measured from the lanyard anchor point:

> ***"Lanyard length + Deployment length + Safety factor 2 m + 1.5 m + 2.5 m = 6 m clearance."***

Drag the sliders to see whether a given anchor height clears the required fall path.



Snapshot: 6 m anchor, 2 m lanyard, 1.5 m absorber, 2.5 m safety

REQUIRED VS. AVAILABLE CLEARANCE

Scenario	Anchor (m)	Required (m)	Margin (m)	Band
Low anchor, 2 m lanyard	4.0	6.0	−2.0	Insufficient clearance — DO NOT use this rig
Chapter example (6 m clearance)	6.0	6.0	+0.0	Margin tight — re-rig higher if possible
Comfortable anchor height	8.0	6.0	+2.0	Clearance — at least 1 m margin
Shorter lanyard, smaller deployment	6.0	5.0	+1.0	Clearance — at least 1 m margin
Tall structure, worst-case deployment	12.0	6.3	+5.8	Clearance — at least 1 m margin

Required clearance = lanyard length + absorber deployment + safety factor. Bands: ≥ 1 m margin safe, 0–1 m marginal, < 0 m insufficient.

Manufacturer first

Always follow manufacturer's information for calculating clearance distances.

When the height is less than the clearance

When working at heights of less than 6 m, it is always good practice to attach a suitable-length lanyard to a **high point** on the structure. In the event of a fall, the impact force with the ground or supporting structure would be considerably reduced.

The golden rules

- **ALWAYS** ensure fall arrest attachment points are kept as **high as possible** in order to reduce fall heights to a minimum.
- **NEVER** use an energy absorber that has been **partially deployed**. In the event of a fall the Peak Impact Force could be in excess of the 6 kN that a body can absorb.
- When using a **double energy absorber**, ensure that the lanyard not in use is **NOT** connected to any part of the harness. In a fall, the energy absorber would effectively be bypassed — causing a possible failure of the lanyard webbing.
- **NEVER** use two single energy-absorbing lanyards to make progress along a structure. In the event of a fall onto both lanyards, the maximum peak impact force applied to the body would be **double** the force using a single energy absorber.
- **NEVER** lengthen an energy-absorbing lanyard by adding attachment slings that are too long. Energy absorbers are designed to reduce Peak Impact Forces of a **100 kg person** falling double the length of the lanyard to below 6 kN. Considerably lighter or heavier operatives may generate considerably greater impact forces.
- **NEVER** clip the lanyard's connector around the structure and then back onto the lanyard. In the event of a fall the connector could have a load applied across the gate,

possibly in excess of the MBL in this orientation. Large 'Scaffcrab' type connectors will also be affected by this **'cross loading'** when connecting to irregular shaped structures.

- When using a **mobile fall arrester (EN 353-2)** on a flexible line, **ALWAYS** ensure there is a **stopper knot** at the base of the route to ensure protection from falling 'over the edge'.

Inspection frequency

BS EN 365:1993 gives general requirements for periodic inspections of PPE against falls from height. PPE Regulations require components to be examined **at least every twelve months**.

HSE Specialist Inspector Report No. 59 states that for textile items, this period should be reduced to **every six months**, and for **arduous environments**, **every three months or more frequently** if the risk assessment shows special hazards.

> ⚠ **Construction = arduous**
>
> Work on a construction site would normally constitute an **arduous environment**.

Fall factors

How fall factor is calculated, the FF0 / FF1 / FF2 reference, and the danger of via-ferrata scenarios.

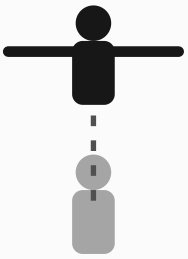
Fall factors

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

The formula

> ***“Fall Factor (FF) = Length of fall ÷ Length of rope holding the fall”***

Drag the sliders to see how anchor position and lanyard length combine into fall factor and peak rope tension.



H = 1.5

Snapshot: 1.5 m lanyard, anchor level with attachment — FF 1.00

FALL FACTOR & PEAK ROPE TENSION (100 KG, NO ABSORBER)

Scenario	FF	Fall (m)	Peak (kN)	Band
Anchor overhead, taut	0.00	0.0	2.0	FF ≤ 0.3 — low-stretch rope OK
Anchor well above attachment	0.33	0.5	5.5	FF ≤ 1 — dynamic rope only
Anchor above attachment	0.67	1.0	7.3	FF ≤ 1 — dynamic rope only
Anchor at attachment (FF1)	1.00	1.5	8.7	FF ≤ 1 — dynamic rope only
Anchor at knees	1.50	2.3	10.4	FF > 1 — energy absorber mandatory
Anchor at feet (FF2)	2.00	3.0	11.9	FF > 1 — energy absorber mandatory
Long lanyard, anchor at feet	2.00	4.0	13.5	FF > 1 — energy absorber mandatory

Fall factor = free-fall distance ÷ lanyard length, capped at 2. Peak rope tension assumes a 100 kg operative and a representative 20 kN/m rope stiffness **with no energy absorber**. A correctly deployed absorber limits peak force to ≤ 6 kN.

Limits in practice

It is important to ensure that the Fall Factor is kept to a minimum.

- **Dynamic rope** is capable of withstanding a FF2 fall when new — but good practice is **not to exceed FF1**.
- **Low Stretch rope** — good practice is **not to exceed FF 0.3**.

Scenario	Fall Factor
Anchor above the user, fall ≤ rope length used	**FF 0**
Anchor at user's feet, fall = rope length used	**FF 1**
Anchor below user, fall = 2× rope length used	**FF 2**

⚠ **Even FF0 isn't free**

Testing has shown that **even at FF0** the dynamic loads applied to both the anchor and the operative could be as much as **double the operative's weight**.

Lead climbing

During lead climbing situations, any potential fall should be mitigated by the use of appropriately spaced **'Running Belays'** to reduce the fall height — and thus the Fall Factor — placed on the system.

The higher a climber ascends with sufficient running belay protection, the lower the resulting Fall Factor. **The overriding consideration is reducing any potential fall height.**

Beyond FF2 — via ferrata

In some situations it is possible to generate Fall Factors **in excess of FF2**.

> *“Example: if you were clipped to the handrails on a bridge suspension cable and you fell, the fall height would be calculated from the height at which you fell to the height at which your fall was arrested. On the Humber Suspension Bridge this height could in some cases be as much as 4 m.* ***With a 1 m cow's tail the fall factor would be FF4.”***

This does not allow for the friction between the handrail and the cow's tail carabiner slowing down the fall — but it highlights the potential for very high Fall Factors.

Some equipment manufacturers produce **energy absorbers specifically for high Fall Factor situations**.

Suspension syncope / trauma (toxic shock)

Why an immobile, suspended person can deteriorate within minutes, and how to handle the rescue.

Suspension syncope / trauma (toxic shock)

Anecdotal evidence suggests that an immobilised person suspended in a harness will begin to deteriorate after as little as **four minutes** — leading to coma and possibly death.

The symptoms

Suspension trauma is a condition in which a person suspended in a harness can experience:

- Pallor, cold sweats, nausea
- Ringing in the ears, blurred vision, dizziness
- Feeling faint, loss of consciousness, and eventual death

The condition appears only to have a serious effect on persons suspended in a harness with a dorsal attachment **without moving** — for example, when unconscious.

Why it happens

Muscular action in moving the limbs normally assists the return against gravity of blood in the veins back to the heart. If the legs are completely immobile, these **'muscle pumps'** do not operate and an excess of blood accumulates in the veins — **venous pooling**.

Pressure from harness straps on veins and arteries could also be a contributory factor. The reduction of circulating blood volume disturbs the circulatory system, leading to critical reduction of blood to the brain.

⛔ **Other organs too**

Organs critically dependent on a good blood supply (e.g. kidneys) can also suffer serious damage, with fatal consequences.

The danger during rescue

Moving a person with venous pooling into a horizontal position can cause a **massive flow of venous blood to the heart**, which cannot cope — potentially causing fatal cardiac abnormalities.

In several clinical trials where test subjects were told not to move, most experienced many of the symptoms of suspension trauma — some including loss of consciousness — in just a few minutes.

Risk reduction

Steps that can minimise the risk:

- Frequent **'pumping' of the legs**, preferably against a firm surface, activates the muscles and reduces venous pooling.
- Harness leg loops should be **well-padded and as wide as possible** to spread the load and reduce restrictions.
- The use of a **work seat** might be advisable if work in one position is to be sustained for an extended period.

ⓘ **IRATA's record**

There have been **no reported cases of suspension trauma** from in excess of 20 million logged man-hours by IRATA members. An **effective, speedy rescue plan is still a requirement.**

Work seats

Your instructor will demonstrate a variety of work seats currently in use.

> ⚠ **Work seats are not PPE**
>
> Work seats are **not PPE** and should be attached in such a way that **double rope security is not compromised** should there be a failure in the work seat.

During the rescue

It would be advisable for the casualty to be **sat-up with the knees elevated slightly**. This can be achieved by suspending the casualty from the **sternal attachment point** and, if possible, positioning the harness leg loops under the knees — elevating them and avoiding a rapid return of venous blood to the heart.

The eventual movement of the casualty to the horizontal should be carried out over an extended period of around **20–30 minutes**. **Medical advice should always be sought.**

CAPÍTULOS · 10

Rescue

Rescue principles, snatch rescues, deviation and re-anchor rescues, mid-transfer, knot, aid-climb and loop rescues.

Rescue

The requirement for rescuing any team member who becomes incapacitated whilst working at height should be identified at the **Risk Assessment** stage and fully described in the **Rescue Plan**.

> ⛔ **The main priority**
>
> The main priority in any rescue is to ensure that the **condition of the casualty does not worsen**. Following this it is essential to have a back-up system, and to increase friction on the descender device to allow for the additional rescue load.

If the rescue scenario is particularly complicated, a **practice rescue** should be carried out to ensure the proposed method can be successfully completed within an acceptable time span.

Rescue equipment

Rescue equipment, including a suitable **First Aid kit**, should accompany all operational rope access teams. This includes sufficient equipment to rescue a technician from any of the rope access situations in which they may be operating.

> ⚠ **Don't dual-use**
>
> Dedicated rescue equipment should **not be used for anything other than a rescue**.

It is essential to ensure that **enough competent team members** are available to assist.

Rig for rescue

If the risk assessment shows that the casualty's position cannot be reached by the rescuer, or that the time required to set up and implement a rescue would prove too lengthy, then a **'Rig For Rescue'** system should be pre-rigged before work commences to allow safe and timely access and egress of the worksite.

Before any rescue

The IRATA Level 3 Safety Supervisor:

1. **Assesses the situation**.
2. **Attempts to communicate** with the assumed casualty to ascertain his/her condition.
3. **Determines whether or not** a rescue is necessary.

The supervisor should hold, as a minimum, a current **HSE Appointed Person Certificate**. Where the location of the work is deemed to be an **extreme location** — where evacuation of a casualty could take hours instead of minutes — additional first-aid training or emergency cover may be required.

Rescue team's orders of priority

1. **Ensure the rescuers do not endanger themselves** whilst carrying out the rescue.
2. **Provide appropriate First Aid Treatment** and **prevent further injury** to the casualty.
3. **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.

Your instructor will demonstrate

Your instructor will demonstrate all rescues. The topics that follow should be used to assist your memory of the procedures.

Snatch rescue — casualty in descent mode

Approaching, securing and lowering a casualty stuck in descent mode, from below or above.

Snatch rescue — casualty in descent mode

Rescue carried out from below

1. **Ascend the casualty's safety rope** with your back-up device on the casualty's working rope.
2. Upon reaching the casualty, place them in **as near an upright position as possible** without endangering the casualty further. This may be achieved by temporarily placing a loop from one side of the chest harness over the top of the descender device.

> ⓘ **ABC of first aid**
>
> The rescuer should consider the **ABC** of first aid (Airway, Breathing, Circulation), and deal with the casualty's condition in the strict order of: **Breathing, Bleeding, Bones**.

3. Using a **2nd back-up device**, place it above the casualty and move the original back-up above the casualty, removing the secondary back-up.
4. Continue ascending **0.5 m above** the casualty and change into descent mode.
5. Remove the casualty's back-up device from the rope.
6. Make an attachment from your descender device carabiner to the **top of the casualty's chest ascender** or the sternal attachment on the harness, with a short sling or chain of 2 or 3 carabiners.
7. Operate the casualty's descender to lower him/her onto the short sling or chain of carabiners and then remove it from the rope.

8. Before unlocking your descender, **employ a braking carabiner** to create additional friction. Descend slowly in a controlled manner, avoiding any jerky movements that could shock-load the system, and employing good casualty management.

Your instructor will demonstrate a number of methods of carrying out the above manoeuvres dependent on the type of harness and descender device being used.

Rescue carried out from above

1. **Descend the casualty's safety rope** with your back-up device attached to the casualty's working rope.

   > ⚠ **Loaded safety rope**
   >
   > If the safety rope is loaded, **'reverse prussik' down the rope** — and see the section on de-weighting the back-up device.

2. Upon reaching the casualty, lock off your descender device and place the casualty in as near an upright position as possible.

3. Make an attachment from your descender device carabiner to the top of the casualty's chest ascender or sternal attachment, with a short sling or chain of 2 or 3 carabiners.

4. Remove the casualty's back-up device from the rope and use this cow's tail to make a **second attachment** to the main attachment point on your harness. Alternatively, use your own long cow's tail and attach this to the casualty's main attachment point on their harness.

5. Operate the casualty's descender to lower him/her onto the short sling or chain of carabiners before removing his/her descender device.

6. Continue with the rescue as described above.

Snatch rescue — casualty in ascent mode

Removing the casualty's loaded chest ascender via a counter-weighting technique.

Snatch rescue — casualty in ascent mode

Before you start

Before implementing a rescue, confirm one is necessary by first **attempting to communicate** with the assumed casualty.

If it is deemed necessary, the **Level 3 Safety Supervisor** should first arrange for the **emergency services** to be notified to ensure they will be on site to receive the casualty upon completion of the rescue.

Rescue carried out from below

1. **Ascend the casualty's safety rope** with your back-up device on the casualty's working rope, and follow the same first 6 bullet points as for the snatch rescue (descent mode). The casualty should already be in a near upright position via his/her chest ascender attachment.

2. **Attach your foot loop to the top of the casualty's chest ascender**, then pass the foot loop through the rescuer's back-up device carabiner. An additional carabiner may be required depending on the type of back-up device and cow's tail/lanyard attachment method.

3. **Stand in the foot loop and pull upwards** on the casualty's harness. This will lift the casualty enough to enable his/her chest ascender to be disconnected from the rope.

4. Lower the casualty until he/she is suspended and follow the procedure as described previously.

> ⓘ **Counter-weighting**
>
> This same **counter-weighting technique** can be used in an Aid Climb or Short Link rescue for removing the casualty's short link or cow's tail.

Rescue carried out from above

Descend to the casualty and follow the procedures as described in the snatch rescue (descent mode) from-above section.

Deviation, re-anchor, transfer & knot rescues

Quick reference for the common rescue scenarios past obstacles in the rope system.

Deviation, re-anchor, transfer & knot rescues

> ⓘ **Demonstrated in training**
>
> Your instructor will demonstrate the many methods for these rescues. The examples below are for your reference.

Deviation rescues

Single deviation: use a spare carabiner to connect into the ropes above you and the casualty by pulling in on the deviation.

Double deviation: utilise the rope-to-rope transfer method past the double deviation.

Re-anchor rescues

Utilise rope-to-rope transfer with the casualty's descender connected through the rescuer's main work positioning point and the casualty's suspension carabiner.

Mid-transfer rescue

Make connections to the casualty and descend to the rescuer until at the vertical position.

Knot rescue

Rescue the casualty using a rescue rope connected to the working line — transfer with the casualty onto the new rope and descend.

Aid climb, short link & fall arrest rescue

Use the **counter-balance method** to either descend with the casualty or lower them.

Large re-anchor & stuck-in-loop rescue

Rescuing a casualty trapped in the loop of a re-anchor — the 10-step procedure.

Large re-anchor or stuck-in-loop rescue

For a casualty on the far side of a **large re-anchor**, utilise the **rope-to-rope transfer** method.

If stuck in four ropes (i.e. the loop)

Approach from the casualty's ascent side where possible.

1. **Rescuer ascends ropes to top** and changes into descender.
2. Rescuer attaches **short and long cow's tail** onto loop ropes.
3. Rescuer descends using the loop as a **tensioned rope** to the casualty.
4. Rescuer **removes the casualty's hand ascender** and gets as close to the casualty as possible using a gri-gri.
5. Rescuer attaches cow's tail to the casualty's **central D-ring** below the loop.
6. Rescuer attaches a **short connection** between the rescuer's descender carabiner and the casualty's **sternal D-ring** below the loop.
7. Rescuer places an ascender (minus cow's tail and foot loop) on the working rope above their descender. Add a 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**.
8. As the rescuer stands, the rope is pulled through the descender — **both rescuer and casualty ascend**. Rescuer **removes the casualty's chest ascender**.
9. Rescuer **unlocks the casualty's descender** and lowers across the loop.

10. Rescuer climbs the rope through the descender until the casualty's descender has become loose. Once off the loop, rescuer places the control rope through an **extra carabiner below the descender** on the harness for added friction. Rescuer **descends to ground with the casualty**.

CAPÍTULOS · 11

Hauling & lowering

Mechanical advantage, hauling systems, lowering systems and self-locking pulley setups.

Hauling & lowering rescues

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

Typically **2:1, 3:1, 6:1 and 9:1** mechanical advantages (theoretical) and counterweight systems are used during the hauling element, and subsequently disengaged to allow the casualty to be lowered to a new position.

> ⚠ **Watch the lowering angle**
>
> Consideration should be given to the effects of the lowering element of the rescue being at a **different angle to the hauling element**, and the subsequent sliding potential of the rigging strops.

A suitable method of paying out the back-up rope should be adopted — with special consideration given to the effects following failure of the main lowering rope.

When to rig for rescue

Where operatives are required to operate in a **confined space**, give consideration to **'Rigging for Rescue'**.

A suitable **self-locking descender device** pre-attached to the working rope allows for easy and quick implementation of a rescue hauling system in the unlikely event of a rescue situation developing. The same Rigging for Rescue system should be implemented wherever there is a need for the casualty to be hauled up to a safe location.

Otherwise — use gravity

In all other rescue situations, systems utilising the effects of **gravity** should be implemented in order to lower the casualty to a safe position where effective first-aid treatment can be administered by a suitably competent person.

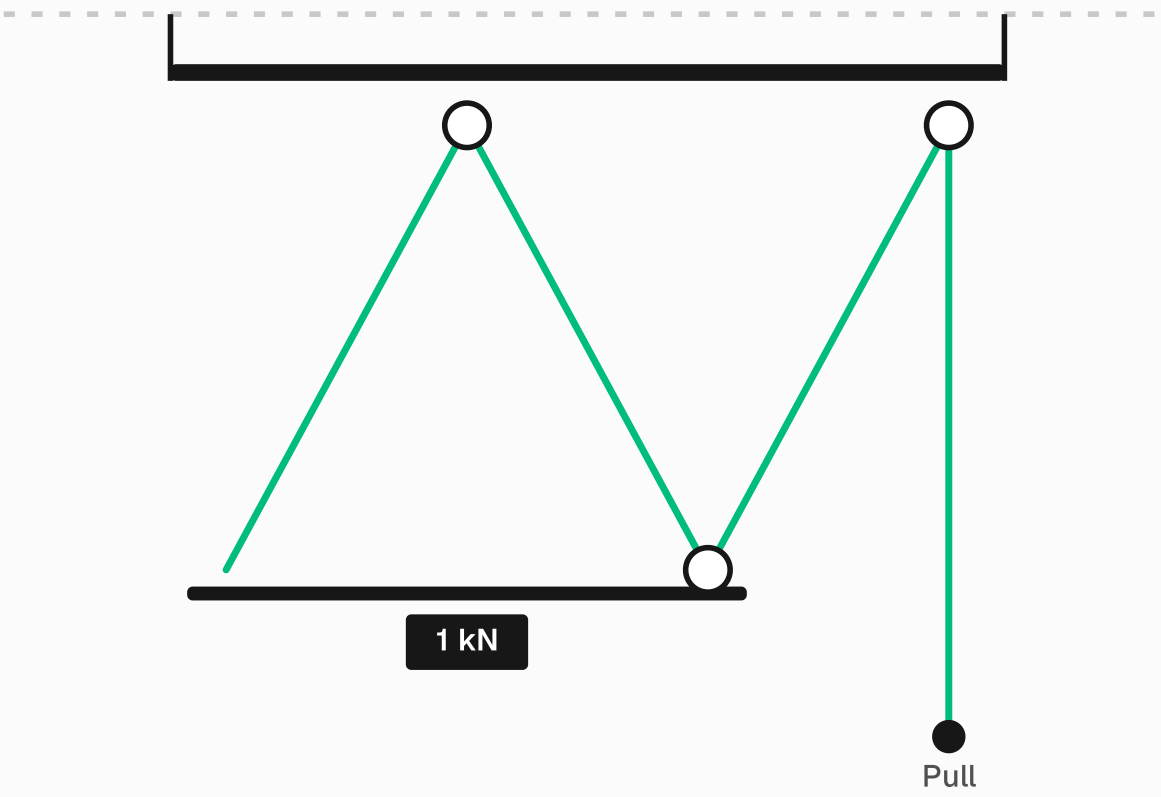
Mechanical advantage — 1:1 to 9:1

How much rope you pull for each metre of load lifted in common pulley systems.

Pulley systems — mechanical advantage

System	Mechanical advantage
1:1	Single fixed pulley — no advantage, only redirects the load.
2:1	One moving pulley at the load — pull twice the distance for each metre of load lifted.
3:1	One fixed + one moving pulley — pull three times the distance.
6:1	Compound system — pull six times the distance.
9:1	Compound system with additional redirect — pull nine times the distance.

The higher the mechanical advantage, the **less force** the operator applies — but the **more rope** must be pulled through the system.



Snapshot: 3:1 at 8% friction per sheave

FORCE, ROPE & EFFICIENCY AT 8% FRICTION PER SHEAVE (1 KN LOAD, 10 M LIFT)

System	Real MA	Input (kN)	Rope to pull (m)	Band
1:1	1.00 : 1	1.00	10.0	Good efficiency
2:1	1.92 : 1	0.52	20.0	Good efficiency
3:1	2.77 : 1	0.36	30.0	Good efficiency
4:1	3.55 : 1	0.28	40.0	Good efficiency
5:1	4.26 : 1	0.23	50.0	Good efficiency
6:1	4.92 : 1	0.20	60.0	Good efficiency
9:1	6.60 : 1	0.15	90.0	Fair — friction is biting

Friction model: real MA = $(1 - \eta^N)/(1 - \eta)$, where $\eta = 1 - f$ and N = strands at the load. Bands: ≥80% good, 50–80% fair, <50% poor.

Friction reduces real-world MA

Real-world mechanical advantage is lower than theoretical because of pulley friction and rope deflection — choose pulleys with low-friction bearings to keep efficiency high.

Self-locking pulley systems

Using an ascender or descender as the locking element, and the always-required back-up system.

Self-locking pulley systems

Ascender + pulley at the anchor

When an **ascender** is incorporated with a pulley at the main anchor point, the rope is stopped from sliding back over the pulley. This is the **most efficient type of hauling system** as it produces the least friction.

It is limited by the fact that a load **cannot be lowered** without introducing a lowering system. The hauling system shown in your training materials gives a **3:1 mechanical advantage**.

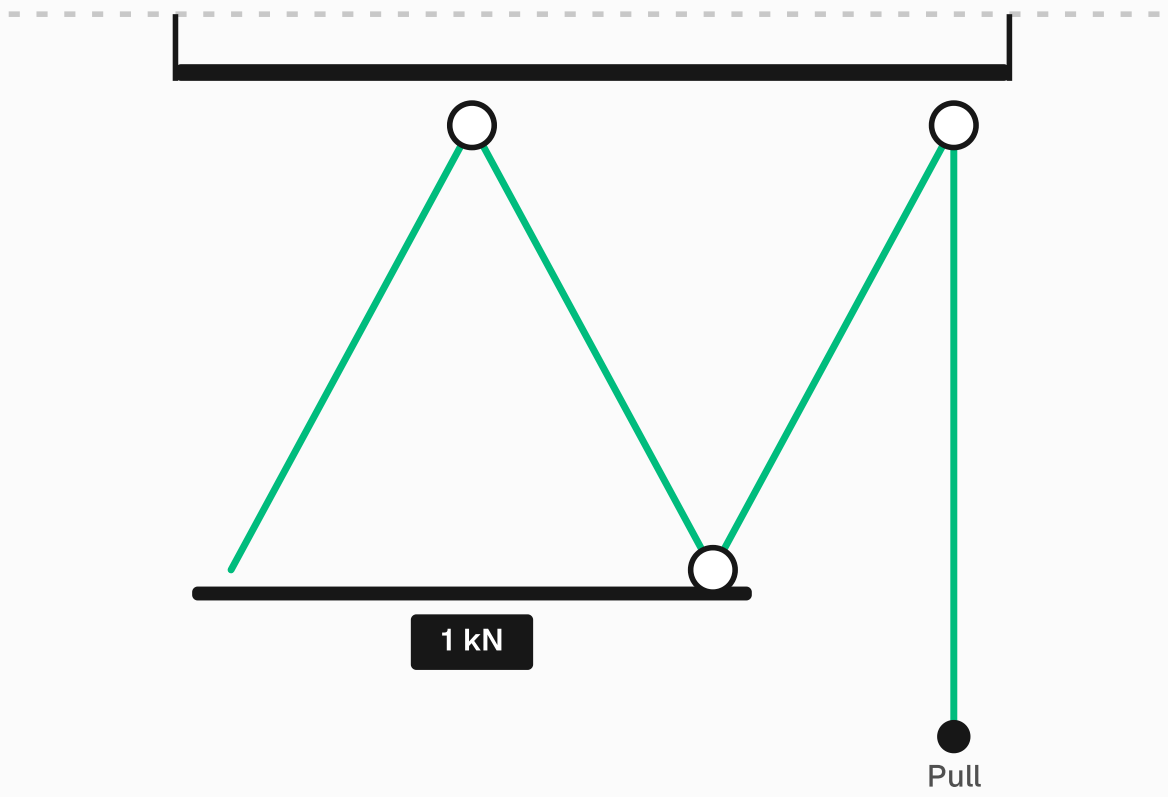
> ⓘ **Replace the ascender with a descender**
>
> By replacing the main anchor point ascender and pulley with a suitable **descender device**, you offer the **most efficient hauling and lowering system**, with increased mechanical advantage being easily implemented.

Descender as the locking device

More friction is introduced to the system by the addition of a **descender** as the locking device. This system is **more versatile** as it can be converted easily to a lowering system. However, because the system is based around a **2:1 mechanical advantage**, a rope that is **double the length of the lowering distance** is required.

The hauling system in this configuration provides a **6:1 mechanical advantage**.

Toggle between the two systems and see how cam grip changes the rope required per metre lifted.



Snapshot: Ascender + pulley (3:1) at 8% friction, 98% cam grip

EFFORT & ROPE USE AT 8% FRICTION

Scenario	Real MA	Input (kN)	Rope (m)	Band
Ascender + pulley, perfect grip	2.77 : 1	0.36	3.00	Cam grip ≥ 95% — safe to use
Ascender + pulley, 95% grip	2.77 : 1	0.36	3.16	Cam grip ≥ 95% — safe to use
Ascender + pulley, worn cam	2.77 : 1	0.36	3.41	Cam grip < 90% — REPLACE the device
Descender + pulley, perfect grip	4.92 : 1	0.20	6.00	Cam grip ≥ 95% — safe to use
Descender + pulley, mid-life cam	4.92 : 1	0.20	6.52	Cam grip 90–95% — inspect for wear

Rope per metre lifted = ratio ÷ (1 − slip). Cam grip below 100% means each pull cycle gives back some height before the cam re-engages. Always pair with an independent back-up.

Always have a back-up

⛔ **Secondary back-up is mandatory**

In cases where hauling or lowering is taking place, a **secondary back-up system** should be incorporated to ensure that in the event of a failure of the main system, the casualty would **not suffer a fall likely to cause personal injury or damage to property**.

CAPÍTULOS · 12

Glossary

A reference glossary of terms, acronyms and abbreviations used throughout this manual.

Glossary

A quick reference for the terms, acronyms and abbreviations used throughout this manual. Tap any topic in the chapter list to browse the glossary entries.

A – E

ACWAHT to Exclusion Zone.

Glossary — A to E

ACWAHT — The HSE-led 'Advisory Committee for Work at Height Training'.

Anchor / Anchorage — A place, fixing or fixture to which an anchor line is connected.

Anchor Line / Anchorage Line — A flexible line connected at least at one end to a reliable anchor to provide a means of support, restraint or other safeguard for a person wearing a harness in conjunction with other devices. An anchor line may be a working or safety line.

ARAA — Australian Rope Access Association.

Ascender — A rope adjustment device which, when attached to a rope of appropriate type and diameter, will lock under load in one direction and slip freely in the opposite direction.

Back-up Device — A rope adjustment device for a safety line of appropriate type and diameter, which accompanies the user during changes of position or allows adjustment of the length of the safety line, and which locks automatically to the rope, or only allows limited movement along it, when a sudden load is applied.

Belay — A place where either anchor lines or people may be anchored or secured.

Belay Device — A device used to adjust the ropes during lead climbing or rescue operations.

Belayer — The person controlling the belay device during climbing or rescue operations.

Body Support — A belt or harness.

Breaking Load (BL) — See also Failure Load (FL), Minimum Breaking Load (MBL). The minimum breaking load of an item of equipment when it is new.

Carabiner / Karabiner — A type of connector, formed as a complete loop, with a spring-loaded entry gate which should be safeguarded in the closed position by a screwed ring

(screwgate), automatic locking device (twistlock) or similar.

CDM — Construction (Design & Management) Regulations 1994.

CE — For rope access equipment, it provides confirmation that a product meets the minimum requirements of the European Directive on Health and Safety: 'Personal Protective Equipment at Work Regulations 1992'.

CHSW — Construction (Health, Safety & Welfare) Regulations 1996.

CITB — Construction Industry Training Board.

Competent Person — A person with sufficient professional or technical training and knowledge, actual experience and authority to carry out their assigned duties, recognise potential hazards, detect defects or omissions which may have health and safety implications, and specify remedial actions to mitigate the implications.

Conformity Certificate — A certificate issued by the manufacturer or equipment supplier confirming that the item of equipment meets the requirements of the appropriate Directive and conforms to any standard that it claims to meet.

Connector — An openable device used to connect components, which enables a person to link him- or herself directly or indirectly to an anchor. It should as a minimum be of the double-closure type (screwgate, twistlock or similar).

COSHH — Control of Substances Hazardous to Health Regulations 2002.

Cow's tail — A short length of dynamic rope connected to the main attachment point of the harness.

CSCS — Construction Skills Certification Scheme.

Descender — A manually operated, friction-inducing rope adjustment device which allows the user to achieve a controlled descent and a stop with hands off anywhere on the anchor line.

Dynamic Rope — A rope specifically designed to absorb energy in a fall by extending in length, thereby minimising the impact force.

EN — European Norm (or Standard).

Energy Absorber / Shock Absorber — Component(s) in a fall arrest system, designed to minimise the impact force generated by a fall.

Exclusion Zone — Zone designated to exclude the public from a hazardous area and from rope access equipment, or to exclude the operatives from a hazardous area, unless suitably protected.

F – L

Factor of Safety to LOLER.

Glossary — F to L

Factor of Safety (FOS) — The MBL is divided by a factor to arrive at the SWL or WLL. This provides a 'safety buffer' between safe use and failure. Expressed as a ratio, e.g. 10:1.

Failure Load (FL) — The minimum breaking load of an item of equipment when it is new. See also Minimum Breaking Load (MBL), Breaking Load (BL).

Fall Arrest System — Personal fall protection system intended to prevent a falling person from hitting the ground or obstructions, and designed to limit the impact force of the fall and retain the user in a near-upright position in the harness.

Fall Factor (FF) — The measure of the severity of a fall. The maximum height a person could fall if held by the rope/lanyard, divided by the length of the rope/lanyard, measured from the person to the anchor point.

FASET — Fall Arrest Safety Equipment Training. The body set up in 2000 for regulating the Fall Arrest Safety Net industry.

FISAT — Technical & Representative Association for Industrial Rope Access Working Methods. (German rope access body.)

HASG — The Height & Access Safety Group. Advisory group of 'Work at Height' PPE equipment manufacturers.

HSC — Health & Safety Commission. The UK Government body that creates health and safety legislation for industry.

HSE — Health & Safety Executive. The UK Government body that enforces health and safety legislation for industry.

IRATA — Industrial Rope Access Trade Association.

Kernmantel Rope — Textile rope made of a core (kern) enclosed by a sheath (mantel).

kg — Kilogram. 1000 Grams. SI unit of mass.

kN — Kilonewtons. 1000 Newtons. SI unit of force. See N.

Lifting Equipment — Equipment for lifting, supporting or lowering loads and persons (LOLER), including its attachments used for anchoring, fixing or supporting it — e.g. chain or rope sling or similar, ring, link, hook, plate clamp, shackle, swivel, eyebolt, carabiner, Maillon Rapide or webbing.

Lifting Plan — Equipment requirements and methods to be used for a lifting operation.

LOLER — Lifting Operations & Lifting Equipment Regulations 1998.

Low Stretch Rope — A textile rope with lower elongation and, therefore, less energy-absorbing capacity than a dynamic rope. See also Semi-Static Rope.

M – R

Maillon Rapide to Running Belay.

Glossary — M to R

Maillon Rapide / Quicklink — A type of connector formed as an open loop, which is closed by a threaded sleeve.

MCG — Major Contractors Group.

MHSW — Management of Health & Safety at Work Regulations 1999.

Minimum Breaking Load (MBL) — See also Failure Load (FL), Breaking Load (BL). The minimum breaking load of an item of equipment when it is tested, new, under specific conditions.

MSDS Sheet — Materials Safety Data Sheet, sometimes referred to as the COSHH Sheet. Information sheet detailing the appropriate PPE that should be worn whilst using a particular chemical.

N — Newton. The SI unit of force. **9.81 N** is the force required to suspend a mass of 1 kg under the force of gravity. It is commonly approximated to 10 N (in common parlance 1 kg = 10 N).

Peak Impact Force (PIF) — The force applied to the body, PPE and the anchor point when a fall is arrested. The PIF is calculated by multiplying the mass of an object by acceleration over the distance fallen and is expressed in Newtons. All fall arrest systems should reduce the PIF to a maximum of **6 kN**.

PPE — Personal Protective Equipment.

prEN — A provisional, or preparatory, EN, yet to be finalised. Levels of revision are dated.

Proof Load — A test load applied to verify that an item of equipment would not exhibit permanent deformation under that load, at that particular time. The result can then be related to the performance of the test piece under its expected conditions of service.

PSMA — Personal Safety Manufacturers Association.

Pull-Through — A method of installing or retrieving ropes from a position where safe access to the belay point is not possible.

PUWER — Provision & Use of Work Equipment Regulations 1998.

RIDDOR — Reporting of Injuries, Diseases & Dangerous Occurrences Regulations 1995.

Risk Assessment — A careful, systematic examination of the hazards in your place of work that could cause harm to people or damage plant or property.

Rope Access — A technique normally incorporating two separately secured rope systems, a harness and other devices, for getting to and from the place of work and for work positioning.

Rope Adjustment Device — A device which, when fitted to an anchor line, will enable the user to vary their position along it.

Running Belay — A method of reducing the Fall Factor and, more importantly, the Fall Height whilst lead climbing a structure using dynamic belaying techniques. The dynamic climbing rope is clipped into carabiners attached to the structure at regular intervals as the operative physically climbs up the structure.

S – Z

Safety Line to Zero Targeting.

Glossary — S to Z

Safety Line / Safety Rope / Secondary Rope / Back-up Rope — An anchor line provided as a safeguard to protect against falls if the rope access worker slips, or if the primary means of support (e.g. the working line), anchor or positioning mechanism fails.

Safety Method Statement — A document prepared by the employer describing how a particular job (or types of job where these will be essentially identical) should be undertaken to ensure that any risks to the health and safety of the workers, or others who may be affected, are minimised.

Safe Working Load (SWL) — The maximum load (as certified by a competent person) which an item of equipment may raise, lower or suspend **under particular service conditions**.

SAIRAA — South African Industrial Rope Access Association.

Semi-Static Rope — Old term for a Low Stretch rope.

Sentry — A person responsible for keeping watch to safeguard the anchorage areas and/or the area of ground below the workers. Such a person should be a full member of the work team and competent for the task but need not be trained in rope access.

SPRAT — Society of Professional Rope Access Technicians (USA).

Static Rope — An old term for rope with lower elongation characteristics than dynamic rope, superseded by the term 'low stretch rope'. Static Rope now only applies to ropes with negligible stretch — e.g. wire or Kevlar — which show little extension at failure and hence having little ability to absorb shock loads.

Suspended Scaffold — Scaffold suspended by means of ropes or chains and capable of being raised or lowered by such means.

Suspension Trauma — A condition in which a person suspended in a harness can experience pallor, cold sweats, nausea, ringing in the ears, blurred vision, dizziness, feeling faint, loss of consciousness and eventual death.

Tensile Strength — The load at which the product no longer has resistance to breakage.

UIAA — Union Internationale Des Associations D'Alpinisme. (International Mountaineering & Climbing Federation.)

UKOOA — United Kingdom Offshore Operators Association.

Via-ferrata — Traditionally a cable-way set up both horizontally and vertically in the Italian Dolomites. By attaching a suitable double lanyard the climber is protected whilst traversing exposed edges or climbs. Very high Fall Factors can be generated in certain circumstances. Some manufacturers have developed energy-absorbing lanyards capable of withstanding these Fall Factors and reducing impact forces on the body to acceptable levels within the mountaineering standards.

WAHR — The Work at Height Regulations 2005.

WHSW — Workplace (Health, Safety & Welfare) Regulations 1996.

Working line / working rope — An anchor line used primarily for suspension, work positioning, work restraint, including descending and ascending.

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. The WLL does **not** account for particular service conditions that may affect its final rating.

Work Positioning — Techniques enabling people to work supported in tension or suspension by Personal Protective Equipment (PPE), in a way that a fall is prevented.

Work Restraint — Techniques utilising PPE to **prevent** a person entering an area where a risk of a fall from a height exists.

Work Seat — A comfort seat for prolonged periods of suspension, with the harness remaining as the primary means of attachment to the anchor lines.

Zero Targeting — The establishment of a system of working which aims to achieve zero accidents, zero waste and zero defects.