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ISO 22846-2

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Personal equipment for protection against falls — Rope access systems —

Part 2: Code of practice

Équipement individuel de protection contre les chutes — Systèmes d'accès par corde —

Partie 2: Code d'application

Reference number
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Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 22846-2 was prepared by Technical Committee ISO/TC 94, *Personal safety — Protective clothing and equipment*, Subcommittee SC 4, *Personal equipment for protection against falls*.

ISO 22846 consists of the following parts, under the general title *Personal equipment for protection against falls — Rope access systems*:

— *Part 1: Fundamental principles for a system of work*

— *Part 2: Code of practice*

Introduction

ISO 22846 (all parts) sets out important criteria for the application of rope access systems for industrial purposes.

ISO 22846-1 sets out fundamental principles; this part of ISO 22846 expands on these, giving recommendations for planning and management, operative competence and responsibilities of personnel, supervision, the selection, use and care of equipment, and advice on how to implement a safe system of work.

Rope access is a method of working at height, typically using synthetic fibre kernmantel ropes and associated equipment, used to gain access to, be supported at, and as a means of egress from, a place of work.

The application of rope access methods are regarded as a complete system, in which planning, competence and suitable equipment are equally important. The malfunction or removal of any component in the system can weaken the operation or prevent the system from operating properly.

This part of ISO 22846 is intended for use by all persons concerned with the use of rope access, including operatives, specifiers, managers, rope access supervisors, purchasing personnel, trainers, clients and regulatory authorities. Users are reminded always to take into account the entire system and not just the component parts.

To ensure a rope access system operates correctly, at least the following factors are important:

— system management and planning;

— competence of the operatives and correct team composition;

— equipment selection, use and maintenance;

— proper organization and execution of working methods.

There can also be other issues to consider, depending upon the nature and location of the work, the competence and experience of operatives and possible local or regional legal requirements.

A failure or shortcoming in any of the above can render the entire system deficient.

Personal equipment for protection against falls — Rope access systems —

Part 2: Code of practice

1 Scope

This part of ISO 22846 provides recommendations and guidance on the use of rope access methods for work at height and expands on the fundamental principles given in ISO 22846-1, in conjunction with which it is intended to be used. It is intended for use by employers, employees and self-employed persons who use rope access methods, by those commissioning rope access work and by rope access associations. This part of ISO 22846 is applicable to the use of rope access methods in any situation where ropes are used as the primary means of access, egress or support and as the primary means of protection against a fall, on both man-made and natural features.

This part of ISO 22846 is not intended to apply to the use of rope access methods for leisure activities, arboriculture, general steeplejack methods, emergency personal evacuation or to the use of rope rescue (line rescue) techniques by emergency services for rescue work or for rescue training. Nevertheless, individuals engaged in these and similar activities can benefit from the advice given in this part of ISO 22846.

2 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

2.1
aid climbing
method of progression in suspension, either by moving from one fixed anchor to another or by the use of moveable anchors or anchor points

2.2
anchor
fixture or place for the attachment of lines or persons

2.3
anchor line
flexible rope line connected, at one end at least, to an anchor so as to provide a means of support or other safeguard for a person

NOTE An anchor line may be a working line or a safety line.

2.4
anchor point
attachment point at an anchor for anchor lines or persons

2.5
anchor sling
sling, strop or lanyard made from textiles, wire rope or chain, which is used to provide an anchor point, such as for anchor lines, to anchors to which it is not possible to connect directly

2.6
ascender
rope adjustment device which, whenever attached to an anchor line of appropriate type and diameter, locks under load in one direction and slides freely in the opposite direction

2.7
back-up device
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 safety line or only allows gradual movement along it, whenever a sudden load is applied in one direction

NOTE 1 The event of a fall is an example of when a sudden load is likely to be applied in one direction.

NOTE 2 Some back-up devices have the additional capacity to control energy in the event of a fall.

2.8
competent person
designated person suitably trained or qualified by knowledge and practical experience to enable the required task or tasks to be carried out properly

2.9
connector
openable device used to connect components, which enables the user to link himself/herself directly or indirectly to an anchor

NOTE Common items are carabiners, but may also include shackles, screw link connectors and other suitable items.

2.10
descender
manually operated, friction-inducing, rope-adjustment device, which, whenever attached to an anchor line of appropriate type and diameter, allows the user to achieve a controlled descent and to stop with hands off anywhere on the anchor line

2.11
double protection
method for protecting an operative against falls from a height, whereby two separate and independent connections are made from the operative's harness to anchor lines or the structure, such that the failure of any one connection does not lead to a catastrophic failure or fall

2.12
dynamic rope
rope specifically designed to absorb energy in a fall by stretching, thereby minimizing the impact force

2.13
fall arrest system
personal fall protection system for work at a height by which a fall is intended to be arrested to prevent the collision of the user with the ground or structure

2.14
fall factor
length of a potential fall divided by the length of rope or lanyard available to arrest it

2.15
free fall
fall where there is no or only minimal collision with any obstruction and where there is no or only minimal resistance to the effect of gravity

2.16
harness
arrangement of straps, fittings, buckles or other elements suitably designed to support the body and provide attachment points for the working line and safety line for rope access work

2.17
hierarchy of controls
process of hazard controls whereby a hazard, once identified and assessed for likelihood and severity, is controlled by elimination or, if this is not possible, is controlled or mitigated in a manner that seeks to provide the most effective and practical outcome, whilst relying as little as possible on user intervention or action

2.18
kernmantel rope
textile rope consisting of a core enclosed by a sheath

NOTE The core is usually the main load-bearing element and typically consists of parallel elements, which have been drawn and turned together in single or multiple layers, or of braided elements. The sheath is generally braided or woven and protects the core from, for example, external abrasion and ultraviolet degradation.

2.19
lanyard
line or sling used to connect a harness to a safety line, working line or anchor

NOTE Also known as a cow's tail.

2.20
lead climbing
method of progression, not in suspension, in which the operative is supported by the structure and is protected by a safety line, which is passed through intermediate anchors

NOTE The safety line is passed through an independently anchored fall protection device, which is operated by another person, and by which a fall can be arrested with a limited force.

2.21
limited free fall
free fall not greater than 600 mm and with an impact force not exceeding 6 kN

2.22
low-stretch rope
textile rope with lower stretch and, therefore, less energy absorption than a dynamic rope

NOTE Sometimes known as a "semi-static rope".

2.23
method statement
document, prepared by a manager, which describes how a particular job (or type of job where several jobs are essentially identical) should be undertaken to ensure that any risks to the health and safety of the operatives, or others who can be affected, are minimized

NOTE 1 The method statement may equally describe how a particular type of job, where several jobs are essentially identical, should be undertaken.

NOTE 2 It is also known in some jurisdictions as safety method statement, work method statement or safe work method statement and may form part of documents, such as job safety and environment analysis. Other similar terms may be used in some jurisdictions.

2.24
restraint
technique whereby a person is prevented by means of a harness and other devices from reaching zones where the risk of a fall from a height exists

2.25
rope access
technique using ropes, normally incorporating two separately secured systems, one as a means of access and the other as back-up security, used with a harness in combination with other devices, for getting to and from the place of work and for work positioning

2.26
rope access manager
person who may define and operate a safe system of work applicable to all worksites

2.27
rope access supervisor
person who may implement a safe rope access working system for a particular worksite and supervise operatives undertaking specific rope access tasks

2.28
safety line
anchor line provided as a safeguard against falls

2.29
screwlink connector
connector that is closed by a threaded sleeve, which is a load-bearing part of the connector whenever fully screwed up

2.30
sentry
person responsible for keeping watch to safeguard the anchorage areas and/or the area of ground below or above the operatives

2.31
traversing
broadly horizontal progression, generally using lead climbing or aid climbing techniques or transverse ropes or pulley systems

2.32
work positioning
technique that enables a person to work while supported in tension or suspension in such a way that a fall from a height is prevented or restricted

2.33
working line
anchor line used primarily for suspension, work positioning and restraint, including descending and ascending

3 General

3.1 Rope access should always be carried out as a complete, safe system of work, involving a combination of aspects, each dependent on the proper implementation of the others.

3.2 After determining whether rope access is a suitable access method for the task, the following fundamental principles should be considered in establishing which measures are required for a rope access operation.

a) There should always be effective management, including on-site supervision.

b) Rope access methods can be of varying difficulty and complexity. Over and above the complexity of the rope access methods chosen, other issues should be taken into consideration, e.g. environment, work task, location. This consideration may lead to the modification of factors such as the access method and rescue plan.

c) Individuals should possess the minimum practical skill level appropriate for the work to be undertaken and the environment in which they are working.

d) Different minimum requirements for skills apply to individuals according to their specific level of responsibility, i.e. manager, supervisor and operative.

3.3 The level of complexity or degree of risk presented by the work environment determines

a) the level of skill or experience required by the rope access operatives,

b) the degree of worksite control required,

c) the type of equipment used, and

d) the type of access method required.

3.4 To ensure that a rope access system operates correctly, it is important that at least the following key subjects be addressed:

a) management (management and planning);

b) personnel (competence of the operatives and correct composition of the team);

c) equipment (selection, use, inspection and maintenance);

d) work methods (properly organized and executed work methods).

These subjects are addressed in this part of ISO 22846, each in its own clause or subclause.

4 Management

4.1 Underlying principles

Each of the underlying principles given in this part of ISO 22846 can be regarded as the foundation of a decision-making and planning process, which determines a range of suitable personnel and working methods required for a given worksite. Table 1 shows the responsibility of rope access personnel and the classification of operatives, and provides terms for such personnel, which are used throughout this part of ISO 22846.

Table 1 — Responsibility of rope access personnel

Title	Responsibility
Operative	May carry out specific work tasks under supervision
Supervisor[a]	Able to implement a safe working system for a particular worksite
Manager[b]	Able to define and operate a safe system of work applicable to more than one worksite
[a] The rope access supervisor should always possess the highest level of practical rope access skills required for the task being undertaken. [b] The rope access manager and rope access supervisor may be the same person.	

4.2 Management systems

4.2.1 The aim in planning and subsequently managing rope access work is to create a working environment that maximizes safety and minimizes the risk of error and possible injury. The combination of elements needed to ensure such an environment is often known as a “safe system of work”.

4.2.2 A documented system should be in place to ensure that policies and procedures exist that adequately control the work.

4.2.3 The system should keep up to date with changing practices and legislation and should take into account any known incidents.

EXAMPLE Examples include suspension intolerance treatment recommendations, equipment changes and new techniques.

4.3 Planning

4.3.1 Prior to a rope access project being undertaken, an analysis should be carried out to confirm that rope access is a suitable method and to ensure there are control systems in place that allow the work to be completed safely.

The following are examples of areas for analysis:

a) how easily and safely a suspended operative is able to use any materials, equipment or tools necessary for the work and, in particular, whether the reaction from any tool places the operative at risk;

b) whether the work threatens to loosen material which might then fall on people or equipment below;

c) whether the work at any one location is of a duration that puts the operatives at risk of unacceptable levels of exposure;

d) whether it would be possible to rescue the operatives quickly, using rope access techniques, from any potential position in which they might find themselves.

NOTE In some jurisdictions, there might also be workplace regulations regarding the use of rope access for some tasks.

4.3.2 Prior to any rope access work commencing, a system should be in place to define or provide for at least the following:

a) clear lines of responsibility;

b) safety management policy and procedures;

c) assurance that the rope access supervisor has been authorized by the company to act as necessary for the safety of the operatives, the public and the worksite;

d) procedures for dealing with all hazardous materials, plant, tools or environmental hazards;

e) adequate insurance for the worksite, operatives, public liability and any other aspects that can be relevant to the worksite or the location;

f) a documented risk assessment, which broadly should be in three parts: identification of any hazards, assessment of the likelihood and severity of consequences, and methods of hazard control;

g) project planning;

h) selection of staff;

i) methods for ensuring proper communication of relevant information to all staff;

j) records of staff competence, equipment and inspections;

k) rescue plans and equipment.

4.3.3 The minimum management knowledge recommended is set out in Table B.1.

4.4 Hazard identification and risk assessment

4.4.1 If it has been confirmed that rope access is a suitable method to carry out the intended task, employers should carefully review the procedures to be followed when carrying out the work and determine how hazards can be removed. If it is not possible to remove hazards, employers should examine how risks can be reduced to an acceptable level.

4.4.2 The risk assessment should be documented and should cover all aspects of the work to be undertaken. It should be reviewed regularly during the course of the work in order to account for changing circumstances.

4.4.3 All project planning, hazard identification and risk assessment should seek to follow the hierarchy of controls. The hierarchy seeks to remove hazards or, if this is not possible, to control them to the highest possible degree. In so doing, it reduces the probability of an incident occurring rather than having to deal with the consequences of the incident.

4.4.4 The following steps should be carried out:

a) identify general hazards;

b) identify hazards specific to the task or the worksite;

c) assess the likelihood and consequence of the hazard occurring;

d) seek to eliminate hazards;

e) mitigate against the remaining hazards;

f) determine the experience of personnel required;

g) describe other elements necessary to ensure a safe system of work.

4.4.5 The risk assessment document(s) should be available to personnel working at the site and should be formally reviewed by them at regular intervals during the course of the work.

4.4.6 Several documents can be prepared. For example, a formal hazard identification/risk assessment, which covers the entire worksite or a number of operations, may be produced during planning. However, for the specific on-site work, there is a simpler document which sets out the hazards/risks for that particular worksite. This document can also provide some form of method statement (see 4.6) for the work team to review. The work team may prepare this document at the worksite. Irrespective of where the document is produced, the work team should review it at the worksite.

4.5 Hazards specific to a rope access method or work task

4.5.1 Hazards specific to a rope access method or work task can exist. Examples include:

a) the presence of other trades;

b) the tools being used;

c) the availability of anchor points of suitable size, shape and strength for the proposed access method and work to be carried out;

d) any hazard placing the public or other workers at risk.

4.5.2 The project planning should take into account the environment in which the work takes place, including:

a) the weather;

b) the presence of contaminating substances which are possibly hazardous, such as bird droppings, asbestos, etc.;

c) the presence of power lines;

d) local hazards, such as sources of gases and vapours, heat and corrosion;

e) the presence of moving machinery or tools.

4.6 Method statements

4.6.1 On the basis of the risk assessment and safety policy, employers should prepare a suitable work plan or “method statement”. Separate method statements can be necessary for each particular aspect of the job.

4.6.2 In the method statement, the employer should set out working steps which are to be followed for the particular work situation. In cases where types of jobs are similar, the method statements may be identical and may, therefore, be in the form of a general document, which should include either a specific rescue plan or a procedural outline.

4.6.3 Where the work includes the use of hazardous tools (e.g. welding torches, flame cutters and abrasive wheels), a more detailed method statement can be needed, detailing possible additional controls to be put in place.

4.7 Operating process

To enable a team to carry out a task, a set of operating processes should be put in place that cover at least the following:

a) documented method statement;

b) permits required for the work (e.g. for work in confined spaces, hot work or work offshore);

c) worksite induction requirements;

d) requirements for any additional personnel that might be required, such as traffic monitors;

e) physical hand-over procedures, e.g. between shift changes or worksite contractors;

f) any requirement for worksite-specific documentation, e.g. hand-over documentation, end-of-shift documentation and accident/incident reporting;

g) facilities required for the worksite and the personnel, such as rest facilities, emergency wash facilities, showers and decontamination facilities;

h) worksite inspection and anchorage design/selection;

i) documented system of work;

j) documented system of incident response, including rescue/retrieval;

k) properly trained and assessed personnel;

l) properly supervised personnel;

m) properly equipped personnel;

n) suitable numbers of personnel at the worksite (minimum two);

o) protection of third parties.

4.8 Worksite classification

There are two general classifications of rope access worksites:

a) Simple: rope access worksite unaffected by any adjacent work or trades, where the anchor line follows a simple path from anchor point to ground or platform level, where there is no requirement to pass knots or deviations greater than 20° and where rescues can be carried out straight to ground or platform level.

b) Complex: any rope access worksite where the requirements for a simple worksite cannot be met. The following are examples of additional factors that may define a complex worksite (non-exhaustive list).

EXAMPLE 1 The use of re-anchors or a significant increase in technique, e.g. when secondary techniques are needed, especially for rescue, because a single descent to the ground is not possible.

EXAMPLE 2 Competence in long ascents and special rescue methods, e.g. environment without clear egress at the bottom.

EXAMPLE 3 The presence of other trades or activities in the near vicinity, which can impact on the rope access team.

EXAMPLE 4 Working on construction worksites, power stations, petro-chemical plants and similar, where worksite conditions can be far more complex and demanding.

NOTE Where any doubt exists as to the worksite classification, it is expected that, by default, the team will rate the worksite as “complex”.

4.9 Supervision

4.9.1 Rope access worksites should be properly supervised to ensure the safety of operatives and others who can be affected on the worksite.

4.9.2 It is essential that rope access supervisors have the experience and competence to supervise the rope access work and any potential rescue for each particular rope access project under their supervision. For the competence requirements of a rope access supervisor, see 5.5.3.

NOTE Table A.1 sets out the recommended competence requirements for basic, intermediate and advanced operatives.

4.10 Levels of rope access operative skills

4.10.1 The result of the planning process undertaken should reflect the classification of the worksite; see 4.8 and the required operative skills.

4.10.2 The skills of operatives and the training received by them for a particular worksite classification or work situation should be assessed by the rope access supervisor before the operatives are allowed to work at any worksite.

NOTE Any operative can work on a complex worksite, provided he/she have adequate competence and appropriate supervision is provided.

4.11 Use of tools and equipment

4.11.1 Tools and equipment should be suitable for the work intended and compatible with rope access work.

4.11.2 Operatives should be appropriately trained in the correct use of tools and other work equipment.

4.11.3 Operatives should be able to position themselves and their suspension equipment well away from any moving parts. If this is not possible, extra control measures should be taken, e.g. additional guards or shields.

4.11.4 All tools or loose equipment should be attached in such a way as to prevent hazards caused by objects being dropped. Where it is impracticable to attach tools or other equipment to the user (e.g. because of the weight), they should be suspended independently by a separate line or other method.

4.11.5 Tools that can cause injury to the operative should ideally be fitted with a “dead man’s handle” so that the power is cut off in the event of a mistake, accident or emergency.

4.11.6 How tools react when started up or when jamming occurs should be taken into consideration and appropriate controls should be put in place.

4.11.7 Effective communication between those using the tools and those manipulating the anchor lines is essential.

4.11.8 Consideration of the use of tools can indicate the need for a different access method or additional measures to ensure that operatives remain safe while working. The nature of some work equipment can require that the length of work periods be limited to prevent discomfort to the operative.

4.11.9 Where an operative has to work with restricted vision and/or hearing (e.g. use of a welding mask), it is recommended that a second operative be immediately adjacent to the first to act as a spotter, i.e. to guard against potential problems, such as fire or equipment damage.

4.12 Practices

4.12.1 Before work commences, the rope access supervisor, together with the employer, should ensure that rescue procedures that are adequate for the particular situation have been agreed upon. They should also ensure that sufficient personnel and resources are readily available to carry out those procedures, should the necessity arise.

4.12.2 Where operating on a worksite with more than one discrete working area, adequate supervision should be provided for each of those discrete areas.

4.12.3 Rope access is a team activity. While there are likely to be numerous specific requirements for a team, relevant to the work being undertaken, there are some general points which are common to all worksites:

a) one team member should be responsible for supervision and should be capable of doing this at the level of the work being undertaken;

b) all team members should have adequate, proven competence at the level appropriate to the work being undertaken;

c) all team members, irrespective of their seniority or experience, should “buddy check” each other’s equipment before leaving a safe area, e.g. check that knots are tied correctly, harnesses buckled and adjusted correctly, and connectors closed and locked correctly;

d) on occasion, additional team members can be required to monitor traffic, control hazardous areas, monitor anchorage areas or similar (i.e. these persons need not necessarily possess rope access skills);

e) the organization and management of a rope access worksite requires not only consideration of the access requirements, but also the potential needs of operatives following an incident, e.g. where an operative is injured or following a fall.

4.12.4 When connecting to, and disconnecting from, the rope access system, normally the first connection to be made and the last to be disconnected should be the back-up device.

EXAMPLE Instances of transferral from anchor line to anchor line constitute an exception to this rule.

4.13 Communications

An effective communications system should be in place. The communications system should provide for at least the following:

a) the rope access supervisor is in contact with all team members;

b) the system is relevant to the worksite and conditions taking into account issues, such as noise, interference, other work teams and weather;

c) the system is linked, where necessary, to other people outside the team, such as emergency crews and a worksite controller;

d) the system is clearly understood and useable by all team members.

4.14 Pre-work checking and checks at the start of each day

4.14.1 At the start of each day, the work team should review the risks which can affect the level of safety. This review should refer to the method statement and risk assessment. It is preferable that the entire team carry out this review, that it be documented and that all team members sign the documentation to confirm participation and understanding.

4.14.2 Rope access equipment should be checked carefully before starting work and during the course of the job.

4.14.3 At the beginning of each working day and at other times as appropriate (e.g. while the equipment is being relocated during the day), the rope access supervisor should visually check all anchors and anchor lines.

4.14.4 The rope access supervisor should ensure that operatives follow suitable pre-descent/ascent procedures. Operatives should carefully examine their own harness, descent and ascent devices and anchor lines to check that they are in good condition and function correctly. Before each descent/ascent, visual checks should be made of the anchors and any points on the anchor line where chafing can occur. “Buddy checking” of gear by other members of the team is recommended.

4.15 End of a shift

At the end of each shift, access equipment and work tools should be secured or stored in such a manner as to ensure that they are kept safe until the next use. A formal hand-over to the next shift should take place in accordance with local procedures and rules, at which time any relevant information should be passed on.

4.16 Termination of a job

At the termination of a job, care should be taken to clear the worksite properly, with a final inspection of the area before any permit to work is handed back.

4.17 Record keeping and review

Records should be kept and maintained to allow verification of the status of personnel, equipment and worksite. Typical records include the following:

a) work planning and management:
   1) hazard identification/risk assessments;
   2) method statements;
   3) design criteria for work being undertaken, where required;

b) personnel:
   1) statutory requirements relating to employment, next of kin, etc.;
   2) training and competence records;
   3) experience;

c) equipment:
   1) purchase and obsolescence dates;
   2) records of use;
   3) inspection and maintenance;
   4) user instructions;

5) restrictions or limitations on use;

6) load ratings, e.g. safe working load;

7) batch numbers, serial numbers and other identification markings;

d) incidents:

1) near misses;

2) accidents;

3) investigation results of d) 1) and d) 2).

4.18 Document availability

Relevant documentation should be kept at the worksite and should be available to the worksite personnel for reference during work.

5 Personnel

5.1 Selection

5.1.1 Suitability

5.1.1.1 All staff working at height should have a working knowledge of fall protection principles and methods, in addition to rope access, appropriate to the work being undertaken.

5.1.1.2 In addition to rope access and height safety skills, the selection of team members should take into account the specific tasks to be undertaken.

5.1.2 Personal attributes

Those engaged in rope access work should have the following personal attributes:

a) an appropriate attitude, aptitude, physical capability and training;

NOTE The training is expected to be relevant to rope access and not, for example, activities such as recreational abseiling.

b) adequate physical fitness, free from any disability that might prevent working safely at a height;

c) adequate skill and experience to recognize the various uses and limitations, correct selection, application, use, inspection and maintenance of equipment;

d) adequate skill to inspect, use and maintain/store the equipment they use.

5.1.3 Levels of responsibility

Levels of responsibility are outlined in Table 1. Annex A sets out recommended competence requirements for operatives.

5.1.4 Classification of operatives

Table 2 sets out the suggested three levels of a worksite operative and the method of classification of these levels. Operatives should be trained and independently assessed to verify these levels.

Table 2 — Classification of operatives

Title[a]	Description
Basic operative[a]	An operative possessing the basic level of competence and who should therefore only work under close supervision
Intermediate operative[a]	An operative who has attained enough experience and rope access technical knowledge to undertake more advanced techniques than the basic operative.
Advanced operative[a]	A very experienced operative who has extensive practical experience, is able to demonstrate the skills and knowledge gained, and has comprehensive knowledge of advanced rescue techniques
[a] The three-level system described in this table is one possible classification system. Some jurisdictions may choose to have more levels or less, depending on their needs.	

5.1.5 Selection criteria

5.1.5.1 All rope access personnel should possess at least the following knowledge:

a) different methods of fall protection;

b) access techniques applicable to basic rope access work;

c) general rigging methods applicable to rope access work;

d) anchor selection and use;

e) use of tools and equipment;

f) worksite or client protocols.

5.1.5.2 Rope access operatives should be selected to ensure they

a) are physically capable of performing the tasks required,

b) have adequate competence for the work being undertaken,

c) are capable of following the directions given by the rope access supervisor,

d) are capable of understanding the safety and job requirements of the project, and

e) have suitable tool skills to carry out the work to be undertaken at the work location.

5.1.5.3 Worksites using rope access require the supervision of rope access safety and of the work project itself. These two types of supervision may be the responsibility of different persons or of the same person. This part of ISO 22846 covers only the supervision of rope access safety. Rope access supervisors, in addition to meeting the requirements for rope access operatives, should also have:

a) the competence and experience to supervise the work and potential rescues at the level at which they are required to work;

b) the ability to manage the daily issues at the worksite and transmit to rope access operatives the requirements for the project;

c) the ability to lead a work team;

d) the ability to closely monitor the worksite and the personnel;

e) the ability to complete and maintain documentation as can be necessary for the work.

5.1.5.4 Management staff should be selected with the following additional considerations:

a) competence and experience for the work being managed;

b) the ability to transmit and ensure correct operation of the rope access management system.

5.2 Competence

5.2.1 It is essential that rope access personnel be competent in the safe use of their equipment and in any managerial roles to which they are appointed.

5.2.2 Rope access personnel should have sufficient professional or technical training, knowledge, actual experience and the authority to enable them to:

a) carry out their assigned duties at the level of responsibility allocated to them;

b) understand fully any potential hazards related to the work and equipment used or to be used;

c) detect any technical defects or omissions in that work and equipment, recognize any implications for health and safety caused by those defects or omissions and be able to specify a remedial action to mitigate those implications.

5.3 Training and assessment

5.3.1 Competence is usually achieved through training, knowledge, skills and experience. Training should be delivered by a training specialist to meet competence levels set by the peak body administering rope access in the jurisdiction where rope access works are carried out. Training routes should be clearly defined.

5.3.2 All candidates should be trained in a formal programme, formalized in both time and performance; they should be assessed for competence independently.

5.3.3 Assessments (also known as evaluations) should only be carried out by competent and qualified assessors (also known as evaluators) who are commercially independent of the candidate, the candidate's company and the organization providing the training.

5.3.4 Procedures should be in place to ensure sufficient documentation of the experience of operatives in order to allow verification of the operatives' experience. Documented experience is also useful to help prospective employers judge the experience of personnel at various tasks.

5.3.5 It is essential that employers maintain their employees' level of ability. This requires a reassessment at regular defined intervals and additional training where necessary. To ensure that operatives maintain their skill level, there should be retraining and reassessment at periods not exceeding three years.

5.3.6 Retraining is appropriate for operatives who have not been continuously engaged in rope access work. This can be either a refresher course or a full course at the appropriate level. All refresher courses should include all the techniques covered at the basic level. For experienced operatives and supervisors, the refresher course should concentrate on rigging and rescue procedures plus worksite management.

5.3.7 It is essential that operatives maintain their knowledge of current legislation, industry best practices, techniques and equipment developments.

5.4 Experience

5.4.1 Experience is a key component of an operative's capability. All items of an inexperienced operative's equipment should be checked and verified before the operative is allowed to start work. Inexperienced operatives

should be continuously monitored and not allowed to work without close supervision until the rope access supervisor is satisfied that the operative has achieved a suitable level of competence.

5.4.2 Newly qualified operatives should initially work under direct supervision of the rope access supervisor and then gradually be allowed to progress to working under the close supervision of an experienced operative, at the rope access supervisor's discretion.

5.4.3 As an adjunct to safety, operatives should be encouraged to monitor one another's rigging and safety systems to verify that they are correctly rigged and are safe.

5.5 Competence levels

5.5.1 Knowledge of equipment

All operatives should be able to understand the correct methods of operation and the limitations of any equipment they use, including methods for carrying out pre-use checks and methods of care, storage and maintenance. Skills should include at least the following:

a) ability to select equipment;

b) knowledge of the limitations of individual items of the equipment or system;

c) pre-use inspection;

d) storage, cleaning and basic maintenance;

e) identification of defects;

f) discarding of procedures.

Assessments should verify that this knowledge is in place.

5.5.2 Rope access manager competence

5.5.2.1 The rope access manager should be competent in at least the minimum rope access qualification to ensure the operative's ability to understand the needs of the work team in relation to rope access work.

5.5.2.2 It is the responsibility of the rope access manager to ensure that on each worksite there are appropriate levels of rope access supervision.

5.5.2.3 The rope access manager should also be able to:

a) communicate requirements to rope access supervisors;

b) write standard operating procedures;

c) implement and review such control systems;

d) assess which control measures are suitable (based on experience);

e) overview and manage the execution of the work task using rope access skills.

5.5.3 Competence of rope access supervisor

5.5.3.1 The rope access supervisor's role is to ensure that all rope access work is carried out safely in accordance with the project's goals and with the aim of having no accidents .

5.5.3.2 Differing levels of supervisory skills can be required for access tasks of differing complexity. This is especially so where considering the response to and control of emergency situations, but may also be relevant where the work task is complex or possibly hazardous, i.e. use of chemicals, confined spaces and dangerous tools.

NOTE With some tasks, there can be a requirement for additional supervision unrelated to rope access, e.g. entering confined spaces.

5.5.3.3 The rope access supervisor should only allow rope access work to be carried out by competent operatives and in the manner set out in the documentation for the project.

5.5.3.4 Various jurisdictions can have specific requirements for supervisors, but the following general principles apply. It is important for the rope access supervisor to:

a) hold suitable rope access operative qualifications and be reassessed at regular and appropriate intervals;

b) possess adequate on-rope experience;

c) have experience that fits the specific work task;

d) be able to manage and carry out any workmate retrieval that is likely to be required;

e) have the ability to carry out comprehensive hazard identification and risk assessments;

f) be capable of completing appropriate documentation;

g) have adequate maturity and judgement to supervise others;

h) undergo assessment for rope access supervisory skills and be reassessed at regular and appropriate intervals;

i) have knowledge of worksite occupational and health requirements;

j) be able to interact with other trades on the worksite;

k) possess knowledge of the use of specialized equipment for specific tasks;

l) be able to identify skill requirements, including the need for specific skills, e.g. to work in confined spaces;

m) be able to identify any shortfalls in operator skills;

n) have the ability to manage properly all aspects of the work in addition to rope access issues;

NOTE This can include recognition of deficiencies in expertise required for particular non-rope access aspects of the work, with the ability to acquire additional assistance as a result.

o) possess good communication skills;

p) have leadership qualities appropriate to the rope access team;

q) possess the ability to monitor rope access personnel and the rope access worksite closely;

r) have the authority to make decisions to ensure the safety of operatives, the rope access worksite and the public (e.g. withdrawal of equipment if thought to be unsafe or inappropriate, or stopping works if an unsafe condition arises).

5.6 Rope access team size

5.6.1 Because of the locations and specialized nature of rope access work, all work teams should be properly supervised and self-supporting.

5.6.2 For each work situation, the level of rope access supervision, the minimum and maximum number of the operatives in the work team and their skills should be assessed and established.

5.6.3 A work team should consist of at least two members, one of whom is a rope access supervisor.

6 Equipment

6.1 General

6.1.1 All rope access equipment should be suitable for the intended purpose and selected in accordance with defined criteria, which should be set out in the company's management system.

6.1.2 The specific details of any worksite or work task should be considered at the time of selection of equipment.

6.2 Limits of equipment use and compatibility

6.2.1 Purchasers should ensure that components in any system are compatible and that the safe function of any one component does not interfere with the safe function of another.

6.2.2 Equipment should only be used in accordance with the manufacturer's user instructions.

6.2.3 The equipment chosen should be able to withstand any loads or forces which are imposed on it, with an additional adequate safety margin; the rope access system itself should be designed to minimize the potential loads which can be placed upon it.

6.2.4 During any climbing and traversing activity, there can be a potential for falls to occur and, therefore, appropriate equipment should be chosen and precautions taken.

6.2.5 No item of rope access equipment should be capable of being accidentally removed or dislodged or of becoming unfastened from the anchor lines during use.

6.3 Standards and legal requirements

6.3.1 Equipment that conforms to standards relevant to the intended use should be selected.

6.3.2 If there is any doubt about whether or not a particular standard is relevant to the intended use, guidance should be sought from the manufacturer of the equipment.

6.3.3 Equipment that satisfies the relevant legal requirements in the country of use should be chosen.

6.4 Specific criteria for the selection of rope access equipment

6.4.1 Body supports (harnesses) for use in rope access

6.4.1.1 Work positioning body supports for rope access work may be a sit/chest harness combination or full-body harness, depending upon the nature of the work to be carried out and the jurisdiction where the work is being undertaken.

6.4.1.2 Although work positioning equipment is generally designed to be strong enough to arrest a limited free fall, it is possible for work positioning equipment to not conform to the other essential requirements for a fall arrest system, unless combined with appropriate additional components.

6.4.1.3 Harnesses used should be capable of supporting the wearer in a comfortable working position. Before using a harness for the first time, the user should carry out a suspension test in a safe place to ensure that the harness is comfortable and has sufficient adjustment (e.g. enough to account for extra or less clothing).

6.4.1.4 The selection criteria for harnesses for rope access include:

a) the ability to be adjusted to the operative (size and comfort);

b) the suitability of a sit harness compared with that of a full-body harness (check local requirements);

c) ergonomic factors (suitable for support needed, person and work to be done);

d) suitability of attachment points for devices and/or tools;

e) ability to add or work with a seat;

f) ability to resist “creep” in adjusters;

g) UV stabilization of webbing;

h) ability to resist chemicals, wear and abrasion;

i) suitability of connection locations (i.e. front versus rear).

6.4.2 Ropes for use as anchor lines

6.4.2.1 Normally, only ropes made from polyamide or polyester are suitable for anchor lines for rope access use. Other man-made materials can be useful in special situations, but care should be taken to verify their suitability for the intended use.

6.4.2.2 Ropes should be resistant to wear caused by the rope devices and should be impermeable to penetration of dirt and grit. The majority of rope devices used in rope access are likely to be compatible only with rope of kernmantel construction.

6.4.2.3 Some important factors in the selection of ropes for anchor lines include:

a) knotability;

b) resistance to chemicals, wear and abrasion, and ultraviolet degradation;

c) performance in cold conditions;

d) having a substantially higher melting point than can be generated during rope access operations (including workmate retrieval);

e) compatibility with chosen rope devices, with particular emphasis on acceptable diameter, flattening or diameter reduction when under load, and the ability to be suitably gripped by the device when under load.

6.4.2.4 Low-stretch ropes (also known as semi-static ropes) are almost universally used for both the working line and the safety line. However, low-stretch ropes are not designed to sustain major dynamic loads and should never be used in situations where a high-impact fall or fall factor greater than 1 can occur and/or be sustained, unless due consideration is given to energy absorption requirements.

6.4.2.5 In situations where the possibility of a substantial dynamic load exists, a dynamic rope should be used. There are three categories of dynamic rope: single, half and twin. For rope access, the use of single rope with a nominal diameter of 11 mm is generally recommended.

6.4.2.6 Ropes should be rigged so as to avoid running over sharp, abrasive or hot surfaces.. Where this is not possible, it is essential that the rope be suitably protected, for example by means of rollers or other types of rope protector. Rope protectors made from heavy canvas can offer excellent protection. Rope protectors made

from PVC-coated textiles should be avoided due to potential heat caused by friction. When used, rope protectors should be such that the radius of the surface over which the rope passes is at least twice the diameter of the rope.

The selection criteria for rope protection include:

a) suitability for worksite conditions;

b) suitability for rope construction;

c) ability to be tied off (if required) to be kept in place;

d) ability for the operative to place and pass the protection.

6.4.3 Helmets

6.4.3.1 Operatives should wear protective helmets that are suitable for the type of work being undertaken. Helmets that conform to standards for either mountaineering or industrial use can be suitable. It is possible that some industrial helmets might not be suitable because they do not have sufficient side-impact protection or strong enough chinstraps.

6.4.3.2 The selection criteria for helmets include:

a) appropriate level of protection against hazards as determined by prior risk assessment, e.g. side-impact, abrasion and sparks;

b) weight;

c) ventilation, particularly in hot climates;

d) ability to mount head lamp, ear muffs or visors;

e) unrestricted vision (including above the forehead);

f) ability to adjust to the wearer’s head size;

g) ability to mount communications equipment.

6.4.3.3 Chinstraps on helmets used in rope access work should prevent the helmet from coming off the head. This is typically achieved by the incorporation of Y-shaped straps into the design of the helmet.

6.4.4 Lanyards

The selection criteria for lanyards for rope access include:

a) energy-absorbing characteristics;

b) suitability for the connectors being used, e.g. can require the use of a screwlink connector or a shackle to prevent bunching;

c) adjustable length;

d) suitability for point of connection to the harness;

e) whether manufactured from suitable material, e.g. in some cases, alternative materials such as steel can be more suited than textile;

f) suitable length;

g) protection at points of wear;

h) ability to resist ultraviolet degradation and abrasion;

i) whether the material from which they are made is suitable for the work environment and task;

j) appropriate strengths with an adequate margin of safety;

k) appropriately terminated ends, e.g. sewn terminations, swaged eye.

NOTE In general, handmade slings are becoming little used due to the difficulty in evaluating strength and quality.

6.4.5 Connectors

6.4.5.1 Only connectors with a screwed sleeve or an automatic locking mechanism are suitable for use in rope access. Connectors made of steel should be used if connecting to steel cables, shackles or eyebolts. Connectors that are to be used to attach to an anchor should be of such a design and size that they are able to rotate freely in the anchor without hindrance and without loosening the anchor.

6.4.5.2 Other selection criteria for connectors include:

a) adequate strength in the major and minor axes (noting that most connectors are significantly weaker in the minor axis and, if loading is likely in this direction, particular connectors will need to be used, or else another connection device should be considered);

b) double-action opening mechanism (minimum);

c) locking mechanism suited to the task;

d) adequate gate strength in case of gate loading;

e) suitability to connect to rope or webbing, where required (noting that some webbing slings with wide connection points can load connectors inappropriately and can require the use of other connectors such as shackles);

f) corrosion resistance;

g) suitability for cold, dirty or gritty conditions;

h) suitability for use with gloved hands;

i) resistance to roll-out or induced roll-out (this condition can arise where another component bears against the gate of a connector and either forces it open or, if the secondary function of the connector is inadvertently operated, allows the connector to open and release the load);

j) mouth and opening size to suit work (scaffold tubes, connecting slings, etc. can require large openings);

k) resistance to wear, abrasion and cracking.

6.4.6 Descending devices

The selection criteria for descending devices include:

a) ability to lock automatically whenever in “hands-off” mode;

NOTE Slow creeping along the anchor line is acceptable.

b) good heat dissipation characteristics (important on long descents);

c) mass of the operative;

d) length of descent;

IMPORTANT 1 Although descending devices with a wide range of friction adjustability are not required in all jurisdictions or for all worksites, they are strongly recommended in situations such as long drops, where rope weight is a significant factor or where the weight of the load can vary significantly.

e) suitability to the environment (e.g. wet, muddy or icy);

f) minimization of rope damage, wear or twist;

g) compatibility with rope type and diameter;

h) ability to lock whenever gripped too tightly in panic;

IMPORTANT 2 Although descending devices which lock automatically whenever gripped too tightly in panic may not be required in all jurisdictions, they are strongly recommended, particularly so for less experienced operatives.

i) capability of increased loading during workmate retrieval with double loads;

j) ability to not inadvertently disconnect from the descent line;

k) simplicity to mount on rope and resistance to incorrect mounting;

l) ability to give the operative suitable control over the speed of descent and not cause undue shock loads to the working line during braking.

6.4.7 Back-up devices

The selection criteria for back-up devices include:

a) energy-absorbing capabilities, e.g. a maximum impact force of 6 kN;

b) ability to self-manage (e.g. needing little or no user intervention);

c) ability to arrest a fall gradually rather than suddenly;

d) ability to keep falls as short as possible;

e) compatibility with rope type and diameter;

f) ability to not cause catastrophic damage to safety line or device under foreseeable forces;

g) ability to not inadvertently disconnect from the rope;

h) suitability for work environment, e.g. ice on the rope;

i) suitability for body weight and work method being undertaken;

j) ease of unloading post-fall;

NOTE Ease of unloading post-fall can be an important feature during a workmate rescue/retrieval.

k) ability to position the device on the rope (i.e. in some work situations, the operative needs to be able to position the back-up device at a particular location on the rope);

l) being designed so that any failure of the device results in the activation of a safe mode.

6.4.8 Ascenders

The selection criteria for ascenders include:

a) ease of connection to the rope;

b) ability to not inadvertently disconnect from the rope;

c) ease of adjustment on the rope;

d) resistance to abrasion;

e) capacity to cause minimal damage to rope under foreseeable loads;

f) suitability for specific use, such as on chest mount during climbing;

g) ability to connect slings and other devices;

h) ability to grip in extreme situations, e.g. snow and mud.

6.4.9 Pulleys

Pulleys may be used in a variety of rope access manoeuvres. Pulleys should be load-rated and, where possible, rigged with a back-up connector or similar device. Operatives should be aware of the possible doubling of anchor loads in some rigging situations.

6.4.10 Other devices

Where the suitability of a piece of equipment is unknown, it should be thoroughly evaluated and/or tested prior to use. Where necessary, additional advice should be sought from suppliers and manufacturers.

6.4.11 Work seats

6.4.11.1 Whenever there is a need for operatives to remain suspended in one place for more than a few minutes, support additional to that provided by the harness is recommended; this additional support may take the form of a work seat.

6.4.11.2 The work seat should be fitted in such a way that the harness remains the primary means of attachment to the anchor lines.

6.4.12 Selection of personal protective equipment to protect against risks other than falls from height

6.4.12.1 Suitable personal protective equipment should always be provided for any situation that presents a risk to health and safety. Operatives should be appropriately dressed and equipped for the worksite, work task and environmental conditions.

6.4.12.2 The work environment can pose additional risks to personnel, e.g. effects of weather, harmful substances and sharp objects; these need to be considered. The employer should assess carefully the most appropriate equipment to guard against such hazards and should provide what is needed. Measures should be taken to ensure that such equipment is worn by employees.

6.4.12.3 Equipment should fit properly, be compatible with other items of equipment being used and should not hinder the operative whenever rope access tasks are being carried out. Loose parts of equipment, e.g. straps, which can become caught in moving equipment, should be avoided.

6.5 Equipment marking and traceability

6.5.1 All load-bearing rope access equipment should be marked with a unique identifier, ideally by the manufacturer, to allow traceability from manufacture to final disposal.

6.5.2 Items that have not been provided with a unique identifier by the manufacturer should be indelibly marked in a manner that does not affect their integrity. Particular care should be taken to ensure that webbing and rope products are not marked with damaging chemicals or potentially harmful adhesive products.

6.5.3 Metal items should not be marked by stamping, unless by agreement with the manufacturer.

6.5.4 Equipment should be traceable to the relevant test certificates or certificates of conformity, to known standards or relevant legislation; they should be matched to records of use in order to facilitate its proper care.

6.6 Records of equipment usage

Records should be kept to track the use of individual pieces of equipment. These should include at least the following:

a) unique identification mark;

b) date of entry into service;

c) locations and periods of use;

d) storage location;

e) abnormal uses or conditions in which equipment has been used;

f) details of repairs or modifications;

g) any falls arrested or large loads imposed;

h) any workmate retrieval carried out;

i) any exposure to chemicals, abrasion or heavy grit;

j) date, type and result of inspections.

6.7 Inspection

6.7.1 General

6.7.1.1 Procedures should be established for the inspection of equipment and the method by which this is to be recorded [see 3.4 c) and 4.3].

6.7.1.2 All equipment should be inspected by the user before use. In addition, there should be a formal process for ongoing inspection of equipment by one or more competent persons and the results of such inspections should be recorded.

6.7.1.3 Information on inspection of equipment should be provided by the manufacturer and this should be strictly followed, in addition to the information contained in this part of ISO 22846. To ensure the traceability of inspection and maintenance records, a record card, history sheet or similar record should be kept for each of the items of equipment. Documentation on the inspection, maintenance and servicing history of an item of equipment should be freely available to operatives for at least the life of the item of equipment (see 6.9, 6.11 and 6.12).

6.7.1.4 Should any doubt arise regarding the continued serviceability of pieces of equipment, the matter should be referred to a competent person or the equipment should be isolated or discarded. A competent person can exist within a rope access company or can be a specialist supplier, manufacturer or a specialist repair house.

6.7.1.5 Equipment subjected to an extreme load or a fall should be immediately withdrawn from use and be subjected to a formal interim inspection before either being reintroduced into service or being discarded.

6.7.2 Types of inspection

6.7.2.1 General

There are three types of inspection to which all rope access equipment should be subjected: pre-use check, detailed (formal) inspection and interim inspection.

6.7.2.2 Pre-use check

6.7.2.2.1 The pre-use check comprises a visual and tactile inspection before the first use each day with monitoring during use. Any item showing any defect should be withdrawn from service.

6.7.2.2.2 Daily inspections should not require formal documentation, although some users might wish to include a checklist in daily inspection documentation.

6.7.2.3 Detailed (formal) inspection

Equipment should be thoroughly inspected by a competent person at intervals not exceeding six months, or in accordance with a written inspection scheme. The results of detailed inspections should be recorded in a report.

6.7.2.4 Interim inspection

In addition to the detailed inspection (see 6.7.2.2), additional inspections (called interim inspections) should be carried out where events liable to jeopardize safety have occurred. These are inspections over and above the normal pre-use check. They should be carried out by a competent person at intervals determined by the risk assessment. In determining what a suitable interval is, factors such as whether items are subject to high levels of wear and tear or contamination should be considered. Interim inspections should be recorded.

6.8 Care and cleaning

6.8.1 Information on cleaning and care of equipment should be provided by the manufacturer and this should be strictly followed. In addition, the advice given in 6.8.2 to 6.8.6 should be taken into consideration.

6.8.2 Equipment should, where necessary, be cleaned, washed, dried or otherwise prepared for storage.

6.8.3 Equipment made entirely from metal may be cleaned by submerging for a few minutes in clean, hot water containing detergent or soap. High-pressure steam cleaners should not be used unless expressly recommended by the device manufacturer. Seawater should not be used for cleaning. After cleaning, the equipment should be thoroughly rinsed in clean, cold water and then dried naturally away from direct heat.

6.8.4 Subject to specific manufacturer's instructions, soiled textile items should be washed in clean water with pure soap or a mild detergent, after which they should be thoroughly rinsed in clean, cold water and then dried naturally away from direct heat.

NOTE A pH range of 5,5 to 8,5 (for soap) and a maximum temperature of 40 °C is generally suitable.

6.8.5 If equipment is contaminated by chemicals, it should be withdrawn from service immediately and the manufacturer should be contacted for advice.

6.8.6 If it becomes necessary to disinfect equipment, advice should be sought from the manufacturer or supplier of the equipment about suitable disinfecting agents. There are two points to consider when choosing a disinfectant: its effectiveness in combating disease and whether or not there can be any adverse effect on the equipment after one or several disinfections. Following disinfection, the equipment should be rinsed thoroughly in clean, cold water and then dried naturally in a warm room away from direct heat.

6.9 Maintenance

6.9.1 Information on maintenance of equipment should be provided by the manufacturer and this should be strictly followed. In addition, the advice given in 6.9.2 to 6.9.4 should be taken into consideration.

6.9.2 Maintenance of equipment should be carried out:

a) using the manufacturer's instructions, if available;

b) by competent persons;

c) where necessary, by the manufacturer's representatives or specialist third parties.

6.9.3 Equipment should not be altered without the prior approval of the manufacturer or supplier because its performance can be affected.

6.9.4 If equipment is found to be defective, it should be withdrawn from service. Equipment should, where necessary, be sent for repair or marked as unfit for service and quarantined or discarded. If equipment has been repaired, it should be inspected by a competent person prior to re-entry into service.

6.10 Storage

6.10.1 Information on storage of equipment should be provided by the manufacturer and this should be strictly followed, in addition to the information contained in this part of ISO 22846.

6.10.2 Information on storage of equipment should be provided by the manufacturer and this should be strictly followed. In addition, the advice given in 6.10.3 should be taken into consideration.

6.10.3 Equipment should not be stored wet.

6.11 Retiring equipment

6.11.1 Some equipment is given a lifespan or obsolescence date by the manufacturer. Equipment that has reached such a limit and has not already been rejected for another reason should be withdrawn from service and not used again, unless or until it has been confirmed by a competent person, in writing, that it is acceptable to do so.

6.11.2 Whether or not a specified lifespan has been reached, equipment should be retired from service immediately if its serviceability is compromised or in doubt.

6.11.3 It is important that there be a quarantine procedure for ensuring that defective or suspect equipment, which has been withdrawn from service, does not get back into service without the inspection and approval of a competent person.

6.11.4 Equipment found to be defective at inspection should be withdrawn from service and referred for additional inspection or repair. Such equipment should be marked as not fit for service and, if not reparable, should be discarded or destroyed to ensure it cannot be used inadvertently.

6.11.5 Records should be immediately updated.

6.12 Records

In addition to the recommendations in 6.6, equipment should have records of inspections, cleaning and maintenance, which should be updated each time the equipment is inspected, cleaned or maintained.

7 Working methods

7.1 General

Rope access is primarily concerned with movement up or down, and working while being suspended from ropes. It is considered to be primarily a technique for work positioning. However, the techniques and equipment used for this purpose are sometimes extended to encompass traversing, aid climbing, lead climbing and

other forms of access (for additional techniques, see Annex C). The resulting system can range from a work positioning system to a fall arrest system, with hybrid systems somewhere in between.

7.2 Safety

7.2.1 A rope access system should be configured and used to prevent falls.

7.2.2 One of the key elements of a rope access system is the requirement for double protection. This requirement means that there should always be an access system and a back-up system (see 7.3 and 7.4, respectively). Whenever an operative is in tension or suspension, there should be at least two independently anchored lines; one primarily as a means of access, egress and support (the working line) and the other as additional back-up security (the safety line).

7.2.3 The rope access system should be configured and used to ensure that in the unlikely event of a fall, e.g. in case of incorrect use:

a) the fall distance is minimized;

b) adequate clearance distance is provided so that the operative is prevented from impacting with the ground, structure, lower level or obstacle in the path of a fall (e.g. allow for extension of energy absorber or elongation of back-up line or length of lanyard);

c) any pendulum effect is minimized;

d) the maximum impact force to the operative is as low as possible and, in any case, no greater than 6 kN;

e) adequate protection is provided to ropes and other equipment to prevent them from failure during a fall, its arrest or post-fall suspension.

7.2.4 The rope access system should be set up and used to ensure that:

a) following an incident, operatives are likely to be in a position to self-rescue. This generally means that a front-harness connection point is used to provide the operative with ready access to equipment;

b) operatives are never left working on their own, so that workmate retrieval or the raising of an alarm can be initiated very quickly in the event of an incident;

c) teams have pre-planned responses to potential incidents which include:

   1) communication methods;

   2) suitable equipment;

   3) on occasion, where warranted, ensuring that pre-rigged workmate retrieval systems are in place prior to the work beginning;

   4) pre-planned response methods, including methods of contacting required rescue services and methods of guiding rescue services to the correct position on worksite;

d) all team members carry with them, as a matter of course, the means to travel up and down the rope, and to carry out a rapid workmate retrieval.

NOTE As a general principle, it is desirable that a rescue not expose others to risk and, as such, a non-contact rescue (where the rescue can be carried out remotely from a place of safety) is desirable. On occasions, this can lead to a pre-rigged rescue system being the most appropriate solution.

7.3 Access system

The access system provides the primary support. The access system comprises a working line and the use of descending devices and ascenders, which are always connected to the operative's harness.

7.4 Back-up system

The back-up system provides safety additional to that provided by the access system, e.g. in the event of a failure of the access system. The back-up system comprises a safety line and back-up device, which are always connected to the operative's harness.

NOTE Sometimes rope access methods are used in conjunction with conventional suspended access equipment. Nevertheless, in such cases, the principle of double protection applies to the rope access work. The anchors for rope access are intended to be independent of the anchors for the conventional suspended access equipment. For the safety requirements for work on conventional suspended access equipment, it is intended that reference be made to the appropriate codes of practice and standards.

7.5 Specific techniques commonly used in rope access (non-exhaustive)

7.5.1 Descent

Descent is typically carried out using a descending device attached to the operative and to the working line; otherwise, the operative may climb down the anchor lines using suitable hardware.

7.5.2 Ascent

Ascent is carried out using appropriate ascenders attached to the operative and to the working line.

7.5.3 Passing re-anchors

The operative passes a re-anchor in a way that a minimum of two points of contact/attachment are maintained at all times.

7.5.4 Deviation

A deviation is used to re-position the working line and safety line so that the operative can be in a position other than vertically below the anchor point.

7.5.5 Passing a knot

The operative passes a knot in a rope in a way that a minimum of two points of contact/attachment are maintained at all times.

7.5.6 Changing from one rope to another

The operative changes suspension or connection from one set of working line and safety line to another in a way that a minimum of two points of contact/attachment are maintained at all times.

7.6 Rigging and rope management

An operative with the minimum qualification may carry out rigging and rope management, but this should then be verified by an operative with a higher qualification level. More complex rigging and rope management (e.g. haul systems and load-sharing anchors) are generally undertaken by higher-level operatives, e.g. the rope access supervisor.

7.7 Rigging considerations

7.7.1 Starting work

The employer should provide a safe place of work. Work should start from properly protected safe areas or areas made safe by the installation of temporary guarding or other fall prevention means. Such areas should also have a safe means of access.

7.7.2 Exclusion zones

7.7.2.1 As part of the process of providing a safe place of work, the worksite rope access supervisor should establish appropriate exclusion zones above and below any area of work. In addition, other exclusion zones may be required at other locations such as mid-points.

7.7.2.2 Exclusion zones should at least:

a) be clearly marked or defined;

b) be a physical barrier whenever necessary;

c) take account of the possibility of falling objects and be set up accordingly with regard to factors such as physical strength, location and signage;

d) be enforced where necessary by a sentry or other means;

e) be configured to protect system elements, such as anchor points;

f) protect third parties, e.g. other worksite operatives or the public.

7.7.2.3 The rope access supervisor should designate a hazard zone at anchor level which is large enough to ensure that operatives outside it are not at risk of falling over any working edge. Anchors and anchor points should normally be outside the hazard zone (i.e. in the safe area, generally at least 2 m from an exposed edge) so that the operatives can put on their harnesses and helmets and attach themselves to the descent lines before entering the danger zone. No one should be allowed to enter the hazard zone for any purpose unless they are wearing a harness and are attached to an anchored safety line.

7.7.3 Anchors

7.7.3.1 Examples of anchors are eye bolts, lift-shaft housings, structural steel and natural geological features.

7.7.3.2 When selecting, placing and using anchors, the principle of double protection (see 7.2.2) applies and, therefore, at least two anchors should always be used.

7.7.3.3 When an attachment is made to a structure, even if it is apparent that the structure has more than adequate strength, it is advised nonetheless to anchor each line separately, e.g. via two slings or two connectors.

7.7.3.4 Operatives and rescue services should be aware that additional anchors may be required to facilitate workmate retrieval.

7.7.3.5 Anchors should:

a) be unquestionably reliable;

b) be positioned such that the operative can maintain their work position, relative to the anchors, without difficulty;

c) be placed so that operatives can connect to, or disconnect from, the rope access system in an area where there is no risk of a fall from a height;

d) have a minimum static strength of 12 kN, but preferably of 15 kN.

NOTE 1 The anchor can yield but not fail at these loads.

e) be configured to allow the correct connection of equipment;

f) if for permanent use, be clearly marked with:

   1) the manufacturer's/installer's name and contact details;

2) the service/inspection status;

3) the load rating and direction of loading;

4) a pictogram or other method to indicate the necessity for users to read the instructions for use.

NOTE 2 Some jurisdictions can have additional requirements for anchors.

7.7.3.6 Installers of anchors, which are fixed in concrete slab, rock and masonry, should be aware of a number of safety issues, e.g. minimum distance required between anchors, minimum distance from any edge, correct depth, and specific requirements for solid or hollow masonry. They should therefore be suitably trained and competent. Where possible, anchors should be installed so that they are loaded in shear; extreme care should be taken before deciding to place any drilled-in (to masonry or stone) anchor in a situation where it is expected to be loaded in axial tension.

7.7.3.7 Where dead-weight (ballast-type) anchor systems are used, particular account should be taken of cantilever or frictional effects. It is especially important to be aware that wet or icy conditions can significantly affect the frictional performance of anchor-weight systems, and lateral movement can become unpredictable. The frictional resistance of any anchor weight should be assured by checking that it does not move whenever subjected to a load of four times that which is applied in a work-positioning situation. A higher factor is required if a fall arrest situation is envisaged. If the ballast weight is being used to resist overturning, the manufacturer should be consulted to obtain correct weight requirements.

7.7.3.8 Where counterweighted anchors are used, particular care should be taken to ensure that the device is designed and counterweighted for the potential loads caused by a potential fall. Additionally, the surfaces on which the device is mounted should also be suitable for the significantly higher loads of a potential fall over those normally encountered in the working situation.

7.7.3.9 Sometimes, it is necessary to re-anchor a line, e.g. to avoid a sharp edge or to allow a change of direction. Where possible, re-anchors should be installed so that any potential loads are in shear. Where it is only possible to install anchors in such a position that any forces on them are axially orientated, account should be taken of any reduction in strength caused by such placement and of any advice or limitations that can be placed upon the anchor by the manufacturer.

7.7.3.10 In a multipoint anchor system, the angle formed by the lines between the bight and the two anchors should be as low as possible and should generally not be more than 90° and never beyond 120° (see Annex D). The greater the angle, the greater the force there on the anchors. If circumstances dictate the need for an angle greater than 90°, account should be taken of the increased forces at the anchors, at the anchor line terminations and on other components in the system. The angle should never exceed 120°, unless specifically designed for this purpose.

7.7.3.11 Because of the weakening effect, the feeding of anchor slings or other slings, or strops through themselves (known as lark's footing or choking) should be avoided, unless they are specifically designed to allow this.

7.7.3.12 To meet the recommendations given in this part of ISO 22846, operatives need a separate working line and safety line. Each line should be attached to its own anchor point. These may be connected to each other for added security. A single element of a structure, e.g. structural steelwork, a natural geological feature or a tree can have adequate strength to provide a place for anchor points for both the working line and safety line. This should be verified by a competent person. Supervisors are responsible for checking that the anchor lines are correctly rigged so that if one should fail, a shock load cannot be passed on through the system.

7.7.4 Knots

7.7.4.1 There are many knots which are suitable for use in rope access. It is essential that operatives be able to tie a range of the most commonly used knots.

7.7.4.2 Whenever choosing a suitable knot, operatives should take into account the following:

a) their own skill with that particular knot;

b) the suitability of the knot for the task and anticipated loading;

c) the reduction of strength of the line caused by the knot;

d) the ease of tying and untying of the knot;

e) the ability to pass through or over obstructions, such as pulleys (where required).

7.7.4.3 User-made knotted slings are best avoided.

NOTE In addition to user-made knots, there is increasing use of machine-made terminations (sewn, swaged) on ropes and slings. While not easily adjusted at the worksite by the user, these have the advantage of being made in a quality-controlled environment and their use can be expected to increase.

7.7.5 General issues concerning working on rope (anchor line)

When working on ropes, operatives should be aware of numerous issues. The following is not an exhaustive list.

a) Ropes should be protected over all sharp or abrasive edges.

b) Appropriate precautions should be taken to prevent damage to rope access equipment, when in use.

c) Ropes should be configured so that, if workmate retrieval becomes necessary, it can be readily carried out in a timely fashion; in some cases this can require a pre-rigged workmate retrieval system.

d) Ropes should be rigged to avoid the likelihood of a pendulum in the event of a fall.

e) Ropes should be configured so that an operative cannot inadvertently descend off the rope end. Where the rope is free-hanging, this may be a simple stopper knot. However, care should be taken with likely obstructions, traffic, machinery or power lines, etc. to ensure the knot cannot become snagged. This sometimes leads to the need for additional supervision.

f) Slack in the safety line should be avoided to minimize the length of any potential fall.

g) Connections to safety lines should be kept above the operative at all times to minimize the length of any potential fall.

8 Emergency situations

8.1 General

8.1.1 The survival of an injured person can depend on the speed of rescue and the care given to the casualty during and after rescue. The worksite should be examined at appropriate times (e.g. each day before work commences or in the event that the task changes), to assess possible emergency scenarios and to plan how rescues can be carried out.

8.1.2 Provisions should be made to ensure that help is provided promptly to any operative who needs it. Operatives should be skilled in appropriate rescue techniques.

8.1.3 Specific rescue equipment should always be present at the worksite. This equipment should be sufficient to carry out a rescue from any situation on the worksite. There should be a first-aid kit at each worksite and a competent person trained in first aid available at all times.

8.1.4 If worksite emergencies can occur unexpectedly (nuclear, offshore, refineries, etc.), clear instructions should be given to operatives on the procedures to be taken in such emergencies.

8.1.5 The rope access team should have a planned method for rescue that takes account of the following:

a) adequate equipment;

b) competent operatives;

c) practised techniques;

d) a clearly defined leader;

e) awareness of higher loads involved in rescue;

f) awareness of issues of suspension intolerance (see Annex E) and, in particular, how to manage a patient, post-suspension;

g) provision of medical aid, if required.

8.2 Suspension intolerance (suspension trauma)

8.2.1 An important consideration relating to emergency situations is a condition known as “suspension intolerance”, which can occur whenever an operator is left in a largely vertical position, but is inactive (as can occur if they are unconscious or suspended in a harness or even a stretcher).

NOTE Whenever the casualty is unconscious due to suspension intolerance, the condition is referred to as suspension syncope.

8.2.2 Annex E sets out some additional information on the causes, treatment and supervision of suspension intolerance unrelated to rope access. Information on the condition is evolving and operators should seek to keep themselves informed of the latest information.

9 Welfare

9.1 Operatives require adequate facilities where they can rest in the dry, protected from the cold or heat, and where they can obtain fresh water, store any additional clothing and be able to wash. They should also be provided with, or have access to, adequate toilet facilities.

9.2 In calculating rest periods for operatives, consideration should be given to the effects of adverse climatic conditions and/or difficult or very exposed worksites, because these can affect efficiency and tiredness levels. Working in high and exposed places is likely to subject the operative to factors, such as wind chill or buffeting by the wind, which can have a significant effect on output, at even quite moderate wind speeds.

Annex A
(informative)

Recommended competence requirements

A.1 All grades of rope access operative should be competent in the following:

a) principles and methods of fall protection utilizing the hierarchy of controls (e.g. restraint, work positioning and fall arrest);

b) equipment fitting and pre-use checks;

c) use of back-up system;

d) safe approach to point of descent/ascent;

e) methods of descent;

f) methods of ascent;

g) change from descent to ascent and vice versa;

h) selection of anchor points;

i) elementary rigging and rope management;

j) place and pass a re-anchor/re-belay;

k) simple rescue by lowering;

l) simple vertical rescue by descent.

A.2 Table A.1 gives recommendations for competence and knowledge requirements for basic, intermediate and advanced levels of qualification for operatives for

a) secondary methods of rope access (i.e. more complex),

b) rescue (more than a simple downward rescue), and

c) additional techniques (see Annex C).

Table A.1 — Recommended competence/knowledge requirements for basic, intermediate and advanced operatives*

	Basic	Intermediate	Advanced
Secondary methods			
Install a re-anchor (re-belay)	K	C	C
Use of pulleys (understand and construct simple systems of mechanical advantage)	K	C	C
Place and pass a deviation	C	C	C
Change from one set of ropes to another set of ropes	C	C	C
Rescue			
Rescue of casualty in ascent	K	C	C
Descent rescue via obstruction	K	C	C
Rescue remote casualty by lifting	K	C	C
Rescue with horizontal and vertical movement	K	K	C
Complex rescue participation	K	C	C
Team rescue management	N/A	K	C
Extended techniques (see Annex C)			
Aid climbing	K	C	C
Traversing	K	C	C
Lead climbing	N/A	K	C
Advanced rigging (traverses, etc.)	N/A	C	C
Tensioned ropes	N/A	C	C

Key

N/A = Not applicable at this level.

C = competent, i.e. the person has been assessed as being suitably trained or qualified with regard to knowledge and practical experience to enable the required task or tasks to be carried out properly.

K = knowledge, i.e. the person has some experience and can work satisfactorily under the direction of a supervisor, but has not yet been assessed as being competent.

NOTE The three-level system described in this table is one possible classification system. Jurisdictions can choose to have more levels or less, depending on their needs.

Annex B
(informative)

Recommended minimum knowledge for management of rope access workplaces

Table B.1 sets out the recommended minimum knowledge required for operatives, supervisors and managers.

Everyone engaged in rope access should understand:

a) how to select suitable equipment;

b) the specifications and characteristics of the equipment to be used;

c) the risks arising from the particular work task;

d) the risks arising from different work situations;

e) the principles of the fall protection hierarchy of controls;

f) the fundamental causes of suspension intolerance:

   1) recognition of the symptoms;

   2) action that should be taken;

g) fall factors and their effects.

Table B.1 — Recommended minimum knowledge for management of rope access workplaces

Knowledge	Responsibility		
	Operative	Supervisor	Manager
Knowledge and detailed understanding of legal requirements	X	X	X
Avoidance of risk from falling objects	X	X	X
Control of hazards arising from use of tools	X	X	X
Maintenance of effective communication	X	X	X
Control of all objective hazards	X	X	X
Maintenance of adequate exclusion zones	X	X	X
Understanding of worksite rescue plan	X	X	X
Implementation of procedures for selection, inspection and care of equipment	X	X	X
Completion of worksite records	X	X	X
Implementation of procedures, method statements, work plans	X	X	X
Proper management of all access and work equipment on worksite	X	X	X
Possession of a first-aid qualification	X	X	X
Pre-use inspection	X	X	X
Proper care of personal equipment	X	X	X
Understanding of work task as defined	X	X	X
Carrying out of simple rigging	X	X	X
Monitoring of effectiveness of working methods on worksite	—	X	X
Ensuring personnel, supervision, work equipment are appropriate	—	X	X

Table B.1 *(continued)*

Knowledge	Responsibility		
	Operative	Supervisor	Manager
Planning for any rescue for a particular work situation	—	X	X
Correct storage, care and maintenance (schedule)	—	X	X
Creation of method statement	—	X	X
Provision of first aid and employee welfare	—	X	X
Creation of procedures, method statements, work plans	—	X	X
Reviewing overall effectiveness of working methods	—	X	X
Completion of risk assessments on worksite	—	X	X
Pre-use, detailed and interim inspection	—	X	X
Management of rescue for specified sites	—	X	X
Supervision of rigging of ropes (anchor lines)	—	X	X
Ability to control access methods	—	X	X
Ability to control work tasks	—	X	X
Implementation of method statement set out by manager	—	X	X
Creation of procedures for selection, inspection and care of equipment	—	—	X
Creation and operation of access management system	—	—	X
Creation of generic and task-specific risk assessments	—	—	X
Maintenance of office records	—	—	X
Maintaining records of accident and incident data	—	—	X

Annex C
(informative)

Additional techniques

C.1 General

Techniques that can result in a fall should be used only after a risk assessment has been carried out and the appropriate choice of equipment has been made.

The use of these methods can require additional planning and should take account of the potential difficulties of any workmate retrieval.

C.2 Aid climbing

In this rope access technique, the operative is connected to the structure via the harness using lanyards. It allows an operative to move in any direction on a structure, either in tension, suspension or by using the structure for support. There should always be a minimum of two points of connection and, generally, three. Consideration should be given to the following:

a) planning of the route to ensure that a potential workmate retrieval can take place;

b) lanyard length with regard to minimizing the potential fall distance;

c) sharp edges, which can cause damage to equipment;

d) operative fatigue.

C.3 Lead climbing

This access method allows an operative, using a harness and an appropriate safety line, to climb a structure in any direction, while a second operative controls the safety line, which supports the climbing operative in the event of a fall. The safety line is passed through intermediate anchor points from time to time, at a frequency that minimizes the extent and severity of a fall. This is an advanced technique, which should be well thought out before being undertaken.

Consideration should be given to the following:

a) planning of the route to ensure that a potential workmate retrieval can take place;

b) absence of obstructions in the path of a potential fall (clearance distances);

c) sharp edges, which can cause damage to equipment;

d) minimizing the distance of the operative above the last intermediate anchor point;

e) minimizing slack in the safety line;

f) appropriate spacing of intermediate anchor points;

g) correct operation of the safety line device by the second operative.

C.4 Tensioned ropes (anchor lines)

Where anchor lines are tensioned, e.g. when establishing a cableway system or horizontal anchor line, the increase in the forces at the anchor, anchor line terminations and other components in the system should be taken into account. The potential forces in an incorrectly tensioned system can be catastrophic. The forces should be calculated by a competent person and steps should be taken to ensure that the system is safe before it is used.

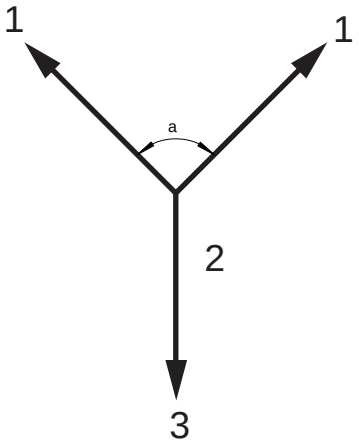
Annex D
(informative)

Anchor loads

D.1 Angle tension factors for rope access

Angles affect the stress placed on ropes and slings when a shared or a “Y-anchor” anchoring system is used.

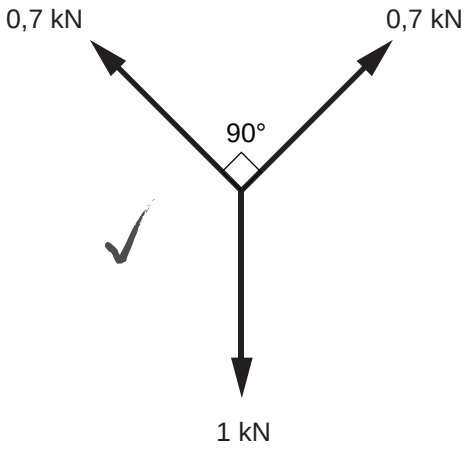
As the distance between the anchors increases, the angle created also increases (assuming the length of the rope or lanyards remain constant). The following are examples of anchor forces on “Y hangs” (i.e. two legs to two anchor points).



Key

1 anchor
2 anchor line
3 load
a Y-angle

Figure D.1 — General arrangement anchor of a Y-anchor system



NOTE The smaller the angle, the better.

Figure D.2 — Preferred maximum angle in a Y-anchor system

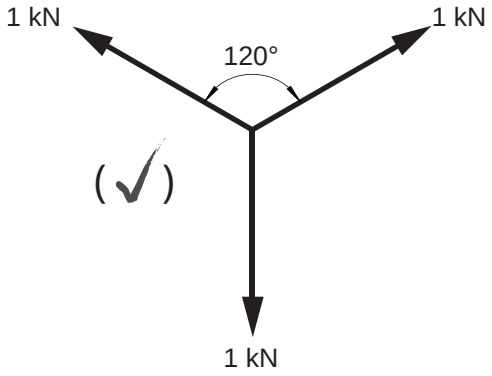


Figure D.3 — Recommended maximum angle in a Y-anchor system

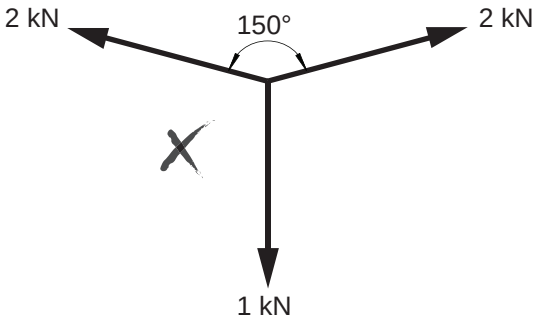
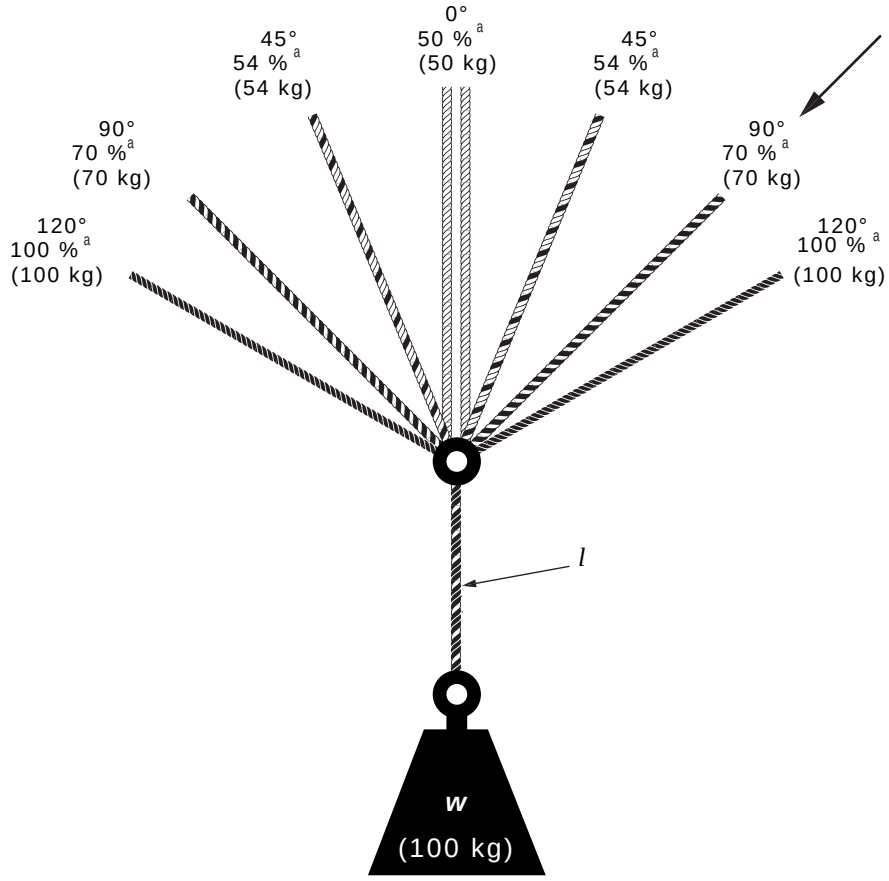


Figure D.4 — Angle to be avoided in a Y-anchor system as any angle over 120° increases the forces dramatically at the anchors

D.2 Effect of increasing the angle and calculation of the applied force

D.2.1 Effect of increasing the angle

The greater the angle, the greater the force placed upon each anchor and connecting anchor line or sling. This increase in force is exponential, not incremental. In rope access operations, the maximum permissible angle is 120°, which applies 100 % of the load on each anchor. A 90° angle places approximately 70 % of the load on each rope and is therefore preferred (see Figure D.5). The arrow highlights the 90° angle.



Key

l lanyard, attached to ropes at various angles

[a] Percentage of load, *w*, experienced at an anchor at various angles.

Figure D.5 — Examples of how the force applied to each rope by the load exponentially increases as the angle increases

D.2.2 Calculation of the applied force

Once the angle formed by the ropes or slings is determined, Table D.1 can be used to calculate the force that is applied to each anchor line or sling. The mass being suspended by the anchor line or sling is multiplied by the percentage tension listed for the angle of the anchoring system.

Table D.1 — Relationship of rope angle to tension

Angle degrees (°)	**Tension** per cent (%)
0	50,0
10	50,2
20	50,8
30	51,8
40	53,2
50	55,2
60	57,8
70	61,0
80	65,3

Table D.1 *(continued)*

Angle degrees (°)	**Tension** per cent (%)
90	70,1
100	77,8
110	87,1
120	100,0
130	118,2
140	146,2
150	193,0
160	287,5
170	574,5

Annex E
(informative)

Suspension intolerance (formerly known as suspension trauma)

WARNING — The information and advice provided in this annex is current at the time of publication. This can change over time. Persons responsible for rescue plans and rescues should keep themselves fully up to date with information and best practice as they evolve.

E.1 The body does not tolerate well being in an upright position and motionless at the same time. Persons likely to be affected are those who are suspended in a generally upright position and who are motionless, for example if seriously injured or unconscious or when fastened vertically in a stretcher. The condition is known as suspension intolerance (formerly known as suspension trauma), orthostatic intolerance and harness-induced pathology).

E.2 Normally, muscular action in moving the legs assists the return, against gravity, of blood in the veins back to the heart. When the body is motionless, these “muscle pumps” do not operate and if the person is in an upright position, an excess of blood pools in the veins of the legs. Excess blood in the veins is known as venous pooling. The retention of blood in the venous system reduces the circulating blood volume and causes a disturbance of the circulatory system.

E.3 The disturbance of the circulatory system causes a number of symptoms, potentially leading to unconsciousness. If the condition is allowed to develop unchecked, it can be fatal. In clinical trials, although some subjects experienced no effects after prolonged suspension, others experienced fainting or loss of consciousness in just a few minutes. Indications suggest that a person’s susceptibility can be unrelated to fitness level.

E.4 Symptoms include a feeling of being about to faint, nausea, breathlessness, disrupted vision, paleness, giddiness, localized pain, numbness and hot flushes; there is initially an increase in pulse and blood pressure and then a decrease in blood pressure below normal. These symptoms are known as pre-syncope. If the cause of these symptoms is not addressed quickly, unconsciousness (known as syncope) is likely to follow and, ultimately, death. Other organs that critically dependent on a good blood supply, such as the kidneys, can also suffer damage, with potentially serious consequences.

E.5 Under normal working conditions, normal movement of the legs (e.g. when a person is ascending, descending or working while suspended) activates the muscles, which should minimize the risk of excessive venous pooling and the onset of any symptoms of pre-syncope. As a precaution, it is recommended that harness leg-loops be wide and well-padded. This should help to spread the load and reduce possible restrictions to blood flow through the arteries and veins in the legs. The use of a work seat should be considered if a given position is expected to be sustained for an extended period.

E.6 Although there is little evidence of the effects of suspension intolerance occurring in the field of industrial rope access, it is essential that there be an adequate rescue plan in place to ensure that, following an incident, a casualty can be removed quickly from the suspended position and cared for correctly. The longer the casualty is suspended without moving, the greater the chances of the effects of suspension intolerance developing and the more serious it is likely to be.

E.7 A person suspended motionless in a harness awaiting rescue is likely to tolerate suspension better with knees elevated. During rescue, elevation of the legs and movement of the knees or feet by the casualty, or assisted by the rescuer where safely possible, can be helpful. The casualty should be removed from suspension as soon as possible. This is particularly important for a casualty who is motionless.

E.8 All rope access personnel should be able to recognise the symptoms of suspension pre-syncope. This is important because motionless head-up suspension can lead to pre-syncope and sometimes syncope in

most normal subjects within 1 h and for 20 % of subjects within 10 min. Syncope can follow thereafter at an unpredictable time.

E.9 During and after rescue, standard first-aid guidance should be followed, with an emphasis on airway, breathing and circulation management (ABC). Assessment of any injuries should include those which are possibly not apparent, e.g. damage to the neck, back and vital internal organs.

E.10 According to advice given in the literature research and assessment carried out by the UK Health and Safety Laboratory in 2008 (see Reference [1]), the fully conscious casualty may be laid down and the semi-conscious or unconscious casualty placed in the recovery position (also known as the open-airway position). This differs from advice which was previously given.

E.11 All casualties who have been suspended motionless in a harness should immediately be taken to additional professional medical care and observation. Medical personnel should be advised that the casualty may be suffering from the effects of suspension intolerance.

E.12 Those preparing rescue plans should regularly review the most up-to-date information and best practice.

Bibliography

[1] HSE/RR708, *Evidence-based review of the current guidance on first aid measures for suspension trauma*. Health and Safety Laboratory (HSL) and the University of Birmingham, HSE Books, 2009. Available at: http://www.hse.gov.uk/research/rrpdf/rr708.pdf

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