



*Fach- und Interessenverband für
seilunterstützte Arbeitstechniken e.V.*

Safety and Working Guidelines for Rope Access

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The ambits of these guidelines are rope access techniques with redundant systems, as well as all comparable operations.

Redundant rope access techniques in terms of this guideline are an approved tool based on the directive 2009/104/EC, which was nationally implemented in the “Ordinance on Industrial Safety and Health” (German: *Betriebssicherheitsverordnung, BetrSichV*), substantiated in the “Technical Regulation for Work Safety” (German: *Technische Regel für Betriebssicherheit (TRBS) 2121-3*).

This guideline serves to implement directive 89/391/EEC of the European Parliament and of the Council concerning the minimum safety and health requirements for the use of work equipment by workers at work.

Special consideration has been taken related to the changes in Article 16, Paragraph 1 (of directive 89/391/EEC) through directive 89/654/EEC; directive 89/655/EEC in relation with directive 95/63/EEC complemented by directive 2009/104/EC (successor of directive 2001/45/EC) and directives 89/656/EEC and 89/686/EEC.

According to the general requirement for the current state of the technology DIN EN 12481:2006 will be regarded in particular.

This guideline respects the following national laws and regulations:

The German Occupational Safety and Health Act, the Ordinance on Industrial Safety and Health (especially annex 2, point 5 following), besides the supplemental “Technical Regulation for Work safety”, (German: *Technische Regel für Betriebssicherheit, TRBS*) – especially the TRBS 2121 (parts 1 to 3) and the DGUV Information 201-018 (former BGI 772).

These safety and working guideline is also based on the internationally applicable standards of the ISO 22159 (rope access) as well as the ISO 22846 (Personal equipment for protection against falls – rope access systems).

This guideline will be applicable for all operators using rope access techniques in heights and depths and who also will have to ensure rescue operations.

Rope access techniques are used when – based on the risk assessment – those can be performed safely, other techniques implicate a higher risk level for the performing rope access technician or a disproportionate effort would occur.

The foundation for the use of rope access is a specific risk assessment. All identified dangers/threats have to be brought to an acceptable residual risk level. Therefore, the immediate rescue and evacuation of all rope access technicians in case of an emergency has to be ensured. The prior protective goal of this safety and working guideline for the application of rope access techniques is the fall prevention of the technicians, as well as the improvement of safety and health care itself for employees and self-employed staff.

The technical solutions mentioned in this guideline don't exclude other, at least equally safe solutions, which are also encountered in the technical rules of other EU member states.

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1. Area of Application

These guidelines will be applicable for all rope access and positioning techniques as well as spontaneous rescue operations related to industrial rope access. This guideline is valid for all users regardless if performed by employees, staff members, self-employed or freelancers.

This guideline applies to rope access of all kinds, except:

- a) Climbing techniques in tree-care services
- b) Stage rigging / rigging in event technology
- c) Outdoor education and rope courses
- d) Rope rescue operations (fire brigade and similar relief units)
- e) Canyoning
- f) Use of rope techniques in sports activities
- g) Caving / cave exploration
- h) Use of PPE against falls from height and associated rescue measures
- i) Use of ropes in leisure activities (such as house-running, mega-dive)

2. Definitions

2.1 Users

Rope Access Technicians in terms of this guideline are trained and certified users of rope access methods in commercial and/or industrial areas.

The following qualification levels are trained and assessed:

- 2.1.1 Level 1 Rope Access Technicians are users with basic knowledge, trained in vertical access methods and workplace positioning.
- 2.1.2 Level 2 Rope Access Technicians are users with extended knowledge, trained in vertical and horizontal access techniques and workplace positioning.
- 2.1.3 Level 3 Rope Access Supervisors are users who are responsible for the safe execution of access methods and work tasks on site. They are trained in extended vertical, horizontal and diagonal access methods as well as in lead climbing techniques.
- 2.1.4 Within the single training levels (Level 1, Level 2 and Level 3) users also learn techniques for a spontaneous rescue operation in occurring emergency.

2.2 Methods/Techniques

- 2.2.1 Rope access techniques are all techniques, where a user installs redundant systems consisting of ropes, positioning lanyards, connectors or other appliances functioning as working line and safety line allowing horizontal or vertical movement and/or positioning.
- 2.2.2 Rope access operations in terms of this guideline are techniques, where a user moves down or up on a working line in order to reach a worksite and to get positioned there (analogue TRBS 2121-3). A redundant safety system/safety line is used at all times. (Analogue DIN EN 12841:2006, paragraph 3, pt. 14).
A typical application is an operation at a storefront or a vertical wall.

2.2.3 Horizontal safety ropes or rope railings in terms of this guideline are operations, where a user moves horizontally on a structure and therefor secures him/herself with an unloaded rope that is installed between at least two anchor points.

The following points need special attention:

- Load capacity of all anchor points (minimum 10 kN). Varying manufacturer's instructions demanding more than 10 kN have to be respected.
- Vector forces
- Pre-tension
- Distance between the anchor points
- Sag under load

A typical application is horizontal movement in supporting or roof structures.

2.2.4 Traversing, aid climbing or point-to-point progression in terms of this guideline is a technique, where a user moves from one anchor point to the next, while using two systems and alternately loads and unloads each of them. In doing so, it always has to be guaranteed that the user is connected to two systems and two separate anchor points. At changing positions, redundancy is maintained by an additional safety system. Due to the permanent alteration at changing position, the used systems serve both as working system and safety system.

A typical application is horizontal movement under supporting structures or below bridges.

2.2.5 Movement below a horizontal structure in terms of this guideline is a technique, where a user moves horizontally while hanging under a structure. Positioning takes place with the help of two positioning lanyards, which are alternately loaded. The unloaded system is shifted along the structure. At changing positions, redundancy is maintained by an additional safety system. The use of an adjustable foot loop for ergonomic movement is recommended.

A typical application is the horizontal movement under supporting beams of a roof.

2.2.6 Horizontal rope lines in terms of this guideline is a technique, where a user moves horizontally on two ropes tensioned between two anchor points each. Two separate connections each of them encompassing both of the ropes are established. The user moves manually by hand or using ascenders. The use of a reverse lock on one of the ropes is recommended.

The following points need special attention:

- Load capacity of all anchor points (minimum 10 kN). Varying manufacturer's instructions demanding more than 10 kN have to be respected.
- Vector forces
- Pre-tension
- Distance between the anchor points
- Sag under load

A typical application is the horizontal movement along a storefront or under supporting structures without anchor points.

2.2.7 Use of ropeway systems in terms of this guideline is a technique, where a user moves along or positions material on two free-hanging ropes tensioned between two anchor points each. The ropeway can run horizontally or diagonally and covers a certain distance through free space independent from a structure. In addition to the redundant ropeway system at least one control or guiding rope has to be installed, which is used for active or passive ascent or descent.

The following points need special attention:

- Load capacity of all anchor points (minimum 10 kN). Varying manufacturer's instructions demanding more than 10 kN have to be respected.
- Vector forces
- Pre-tension
- Distance between the anchor points
- Sag under load

A typical application is the rescue or evacuation from a high-rise building or construction where a direct descent to the ground is not possible due to obstacles, e.g. projecting roofs.

2.2.8 Lead climbing in terms of this guideline is an access method, where a user with an extended qualification and special equipment climbs a short distance over his/her anchor point either vertically or horizontally in order to establish a new anchor point or a temporary belay point. Lead climbing can be performed self-secured by using shock absorbing lanyards or secured by a second trained and certified rope access technician. It is particularly important that the second person is not linked to the safety chain but is anchored to the structure independently. A typical application is the ascent of a girder mast.

This technique should only be used if the risk assessment determines a fall factor of max. 0.3, other techniques are not possible or entail a higher risk factor.

2.2.9 Safety system in terms of this guideline is the redundant system that prevents a fall if the working line fails. Depending on the system used a limited fall reducing the energy may occur.

2.3. Used materials and equipment

2.3.1 Seat harness in terms of this guideline is a harness in accordance with DIN EN 813.

2.3.2 Work positioning harness in terms of this guideline is a harness in accordance with DIN EN 358.

2.3.3 Full body harness in terms of this guideline is a harness in accordance with DIN EN 361.

2.3.4 Mobile fall arrest device in terms of this guideline is an adjustable device for use with ropes in accordance with DIN EN 12841:2006 type A. Mobile fall arrest devices can also be certified in accordance with DIN EN 353-2. Mobile fall arrest devices have to be attached to the sternal attachment point of the full body harness.

2.3.5 Semi static rope in terms of this guideline is a low stretch kernmantel fibre rope in accordance with DIN EN 1891, type A.

2.3.6 Dynamic rope in terms of this guideline is a dynamic mountaineering rope in accordance with DIN EN 892.

2.3.7 Descender in terms of this guideline is a self-braking rope adjustment device, which can be operated manually. Descending devices must be certified in accordance with DIN EN 12841:2006, type C and may only be used by qualified users in connection with semi static ropes in accordance with DIN EN 1891. In addition to DIN EN 12841:2006, type C descenders can be certified in accordance with DIN EN 341 type A.

- 2.3.8 PPE against falls from a height in terms of this guideline is personal protective equipment in accordance with directive 89/686/EEC, which is used in compliance with rule 112-198 of the German Employer's Liability Insurance (DGUV Regel 112-198).
- 2.3.9 Equipment for rescue from height and depth in terms of this guideline is equipment, which is used in compliance with rule 112-199 of the German Employer's Liability Insurance (DGUV Regel 112-199).
- 2.3.10 Lanyard in terms of this guideline is webbing or rope in accordance with DIN EN 354 / DIN EN 958, which for example connects the seat harness of the technician with the fall arrest device or a rope clamp.
- 2.3.11 Connector in terms of this guideline is a carabiner or quick link in accordance with DIN EN 362 or DIN EN 12275. Required minimum breaking strength is 20 kN. Rope adjustment devices in conjunction with a carabiner or quick link in accordance with DIN EN 362 or DIN EN 12275 may also be considered to be connectors. FISAT recommends the use of connectors with a minimum breaking strength of 22 kN along the major axis.
- 2.3.12 Seat (board) in terms of this guideline is equipment designed for prolonged suspension that enables an ergonomic seating posture. The seat can be integrated in the harness. For all work that requires a stationary position of more than 10 minutes in a suspended rope access system, the use of an appropriate seat is obligatory (DGUV Information 201-018). An additional back support is not required, if a suitable combination of harness and seat (board) serves as sufficient support with a wide and semi stiff waistbelt. A footrest made from sewn webbing is recommended.
- 2.3.13 Anchor points in terms of this guideline are structural installations, natural anchor points already existing on the object or artificial anchor devices in accordance with DIN EN 795 or roof safety hooks in accordance with DIN EN 517, that allow anchoring of ropes at various positions and can absorb the forces of working and safety lines. Structural installations can be calculated according to DIN 4426 but have to withstand the following breaking strength. Anchor points are appropriate if they are rated for at least 10 kN. Varying manufacturer's instructions demanding more than 10 kN have to be respected. Testing and certification can be waived if the rope access supervisor rates the anchor point to be sufficient based on his professional experience. A separate anchor point showing the required breaking strength has to be used for each system (working line, safety line). If a rescue load (two person load) is anticipated, anchor points with a higher breaking strength have to be preferred.
- 2.3.14 Sling in terms of this guideline is a lanyard or connecting device, which connects the anchor point with the components of the working or safety line. Slings have to be certified after DIN EN 795 or DIN EN 566 and rated to withstand at least 22 kN.
- 2.3.15 Rope clamp (ascender) in terms of this guideline is a rope adjustment device in accordance with DIN EN 12841:2006 type B. A rope clamp can also follow DIN EN 567.
- 2.3.16 Pulley in terms of this guideline is a device in accordance with DIN EN 12278 which must be rated to withstand at least 15 kN (FISAT recommendation: 22 kN).
- 2.3.17 Mechanical advantage pulley system in terms of this guideline is a pre-rigged or in situ assembled device made from pulleys and rope, which is designed to lift objects or personnel. Pre-rigged systems have to show a minimum breaking strength of 5 kN. All systems or system components have to show a CE sign. The maximum load should not exceed 250kg.

- 2.3.18 Rope protection in terms of this guideline is mats, blankets or rope covers that reliably prevent the rope from being damaged or cut. The primary objective is to defuse the dangerous structure. Pulleys have to be used for running ropes.
- 2.3.19 Edge protection in terms of this guideline is all the appropriate possibilities to reliably prevent damage to or through building elements and the rope under load.
- 2.3.20 Working line / working system in terms of this guideline is a system of anchor points, slings, connectors, rope, ascender, descender and harness. The technician moves from a higher to a lower position independently or moves from a lower position to a higher one either independently or with assistance.
A working line can also be installed horizontally. The building or construction itself may serve as working systems as well. The working line is always connected to the central attachment point of the full body harness. A working line may only be used in connection with a safety or backup system.
- 2.3.21 Safety line / backup system in terms of this guideline is a system of anchor points, slings, connectors, rope, and a mobile backup device, which reliably prevents the user from falling to the ground and reduces the fall energy to a value under 6 kN in the event of a working line failure. All safety systems have to be connected to sternal or dorsal attachment points in accordance with DIN EN 361.
- 2.3.22 Working edge hazard zone in terms of this guideline begins 3 m from the hazardous edge. The hazardous edge is a building or constructive edge where an accident caused by falling or sinking is possible.
- 2.3.23 Emergencies in terms of this guideline arise when a person on rope or in a difficult to access location becomes incapacitated.

3. General Requirements

3.1 Requirements for technicians

- 3.1.1 Users of the described methods must be physically and mentally fit for these activities and have reached the minimum age of 18 years. The minimum age for rope access supervisors is 21 years.
Physical requirements are fulfilled if the user presents a medical certificate for work at height issued by an occupational physician. The check-up should be made in accordance with DGUV Information 250-449 and DGUV principle G41.
- 3.1.2 Persons under the influence of alcohol, drugs or pharmaceuticals reducing the ability to operate vehicles or heavy machinery may not execute these operations.
- 3.1.3 Every technician must provide a valid first-aid certificate no more than 24 months old. For rope access in Germany only certificates issued by institutions, which are authorized by the DGUV (German Employer's Liability Insurance) are accepted. The minimum duration of the first-aid course is 9 teaching units. Higher qualifications according to DGUV Information 204-022 are accepted, if the defined advanced training courses are completed or first aid is rendered regularly on the job.
- 3.1.4 Technicians and supervisors must complete specific training and pass an independent assessment in applied methods and accident prevention regulations according to the examination guidelines of FISAT.

An annual refresher course encompassing the technical skills as well as possible rescue scenarios for the respective level has to be attested by a FISAT appointed assessor. Otherwise a specific advanced training course has to be substantiated.

- 3.1.5 All users have to receive the general instructions in work safety and health care according to German Work Safety Laws and German Occupational Safety and Health Act.
- 3.1.6 The technicians must be trained in the appropriate emergency and rescue measures. Voluntary training of various rescue scenarios on a monthly basis is recommended and should be documented.

3.2 Requirements for the work place

- 3.2.1 At least two trained and appropriately equipped technicians have to be present on every work site. Clear communication has to be established and an immediate rescue within a 15-minute period has to be guaranteed. Therefore, it is necessary that at least two rope access technicians ascend and descend on separately anchored rope systems or that a separate, pre-rigged, anchored and operationally ready system makes an immediate rescue possible. Based on a job specific risk assessment the team must be of an appropriate size in order to execute a quick and effective rescue of all team members in any possible location.
- 3.2.2 All work is to be planned and directed by a Level 3 rope access supervisor with the respective training who is present on site. A supervisor may supervise a maximum of 5 rope access technicians at one time.
- 3.2.3 A safety method statement is required for the general procedures and for each work site after an appropriate, object-specific risk assessment.
- 3.2.4 In case of possible danger through weather effects, operations may only continue when appropriate protective measures guarantee the safety of all technicians at all times. If this is not possible or not guaranteed, all operations have to be stopped or not to be begun.

Danger is to be expected at the following weather conditions:

- Thunderstorm
- Heavy rain or snowfall
- High / Low temperatures
- Glaciation / Icing
- Direct sunlight
- Strong winds / wind gusts (e.g. higher than 8 m/s)
- Wind chill effect

Actual risks have to be assessed for each work place with a specific risk assessment and appropriate safety measures such as protective clothing, additional sets of rope, reduction of working hours, etc. have to be implemented.

The safety measures have to be checked for their effectiveness throughout the duration of the work. If measures are not suitable or effective, all operations have to be stopped.

Operations have to be stopped immediately when:

- Danger through lightning: all exposed areas have to be evacuated immediately.
- Average wind speed exceeds 15 m/s in a 10-minute period.

3.2.5 Additional risks must be taken into consideration and excluded through appropriate measures.

The following points need special attention:

- Exclusion zones: areas surrounding the anchor points and all ropes should be fenced off. Only authorised personnel should be allowed to enter these zones.
- When working in confined spaces (silos, tanks, containers, etc.) an increased risk is to be expected. All appropriate safety measures have to be guaranteed. DGUV rule 113-004 and 113-005 should be consulted.
- When working above water (e.g. offshore) the required safety measures have to be established according to a specific risk assessment.
- When working on residential buildings, the residents should be informed in a timely manner when necessary and appropriate.

3.2.6 Construction site safety barriers for the protection of third parties must be erected in a manner that no entry into the exclusion zone can occur unobserved. The barriers should be erected according to the respective regulations.

See chart 8.2 for safety radius.

3.3 Requirements for operations on construction sites

3.3.1 Only appropriate and properly rated equipment in good operating condition may be used on the construction site.

3.3.2 Additional PPE must be worn if required. In addition to inspected rope access equipment in good working order and the inspected personal protective equipment against a fall from height in good working order, adequate protective clothing has to be worn. It is obligatory to wear appropriate head and foot protection.

3.3.3 A separately packed and labelled rescue bag (contents based on the specific risk assessment) has to be available at each work place as per DGUV regulation 1 and DGUV rule 112-198. An emergency plan has to be available.

3.3.4 If an increased risk exists regarding emergency and rescue measures; e.g. caused by the object's structure, the access method or the number of personnel involved, the emergency plan has to guarantee the availability of an adequate number of appropriately qualified personnel.

4. Verification Management

4.1 Verification for material and equipment

4.1.1 Durable labels should be applied to all ropes and components used for a rope access system unless they can clearly be classified in another manner.

4.1.2 A verification log covering the condition and inspection of all equipment must be maintained either on paper or computer based.

4.1.3 The application of labels is not appropriate for certain kinds of equipment such as carabiners, cordage or other small pieces. For those materials, collective proof has to be maintained.

4.2 Personal verification

- 4.2.1 Each technician has to maintain a personal safety logbook. Alternatively a computer based list can be maintained.
- 4.2.2 The personal safety logbook should contain the first aid certificate and all subsequent refresher courses as well as copies of all relevant qualifications.
- 4.2.3 The main part of this book serves as a log for operational rope access experiences. The logged hours may include preparation and rigging, working hours on rope as well as post-work debriefing. Office work is not to be included.
If a minimum number of working hours is required as admission pre-requisite for an assessment, FISAT's Personal Safety Logbook for Rope Access serves exclusively as proof for logged experience.
All entries have to be confirmed by the responsible rope access supervisor (FISAT Level 3). Confirmation can only be considered correct when the supervisor's name and FISAT identification number are clearly readable and the signature is visible.

4.3 Construction site logbook

The construction site logbook, maintained by the supervisor in charge, must contain the following:

- Risk assessment
- Emergency and rescue plans
- Access and safety concept
- Proof of work safety and health protection training

5. Procedures

5.1 General regulations

- 5.1.1 It is obligatory to use two independent systems (working line and safety line) at all times. As a rule, each system must have a separate anchor point (in accordance with 2.3.13 of this guidelines). If, based on the circumstances of the location, one single anchor point is used for working line and safety line this anchor point has to show a minimum breaking strength of 20 kN. Working line and safety line have to be attached separately. Technicians have to guarantee that they are connected to both the working line and the safety line at all times.
- 5.1.1 Used ropes must be a low stretch semi static kernmantle ropes according to DIN EN 1891 Type A.
- 5.1.2 The only exception to this (5.1.1) occurs when the danger of a fall factor $> 0,3$ exists while lead climbing. In this case a dynamic rope is used to ensure the safety of the lead climber. In this case, special attention should be paid to the possible contact with obstacles and building parts.
If method statement and risk assessment display and guarantee a fall factor below 0,3, a static rope can also be used to belay a lead climber.
- 5.1.3 Used slings, lanyards and connecting devices must have a minimum breaking strength of 22 kN. They must have a factory-sewn bond and/or connection.

- 5.1.4 Used connectors must have a locking system against unintentional opening. Gates should be secured with a mechanism that allows opening with at least two independent movements only. The use of connectors with an increased resisting force against punching shear of the locking mechanism's sheath is recommended.
- 5.1.5 Used harnesses must be in conformity with the standard DIN EN 361. They must show at least one central and one sternal attachment point (sit harness). Full-body harnesses are recommended.
- 5.1.6 Sit harnesses (DIN EN 813:2008 -11) may only be used in conjunction with the appropriate chest harness. This combination may only be used in the safety system if tested and approved by the manufacturer in accordance with DIN EN 361 (as per TRBS 2121-3, 4.1).
- 5.1.7 Personal protective equipment against falls from a height must be used in the fall hazard zone (3 m from the edge) at any time. These can be either a restraint system or a shock absorbing system.
- 5.1.8 A seat (board) is required for rope access operations lasting longer than 10 minutes. The seat can be abandoned if it presents a higher risk than working without the seat (board).
- 5.1.9 If ropes could be damaged due to redirection over an edge or friction on an incline, appropriate rope protection must be emplaced.
- 5.1.10 All ropes must be secured to avoid overrunning the ends while descending. This can be ensured via factory sewn loops or stopper knots.
- 5.1.11 Rope connections should always be in the form of a factory sewn and tested loops. For ropes without a sewn loop, knots can be used.

Knots must fulfil the following requirements:

- They may not loosen or open themselves unintentionally
- They must be appropriate for the intended use

The following knots are recommended for anchoring ropes:

- Figure of eight loop, figure of nine loop, (secured) bowline hitch, double bowline hitch or clove hitch
- Every knot is to be secured by a safety knot (double overhand knot)

- 5.1.12 Only self-breaking devices may be used on the working line. Those devices must stop automatically when released and should have an anti-panic function.
- 5.1.13 Tools and materials have to be secured against falling.

5.2 Regulations for rescue procedures

- 5.2.1 All rescues are carried out using redundant systems (working line and safety line) for both, the rescuer and the helpless person. Rescue can be done active or passive. Rescue of a user of PPE against falls from a height as per DGUV rule 112-199 (only one system, no redundancy) should only be considered in exceptional cases and with particular care for the safety measures.

- 5.2.2 Anchor points may only be used for a two-person load, if they fulfil the requirements of point 2.3.13 of these guidelines. Otherwise, two additional separate anchor points should be selected for the rescue system.
- 5.2.3 During all rescue procedures, the safest and simplest rescue equipment and techniques should be applied, always considering medical aspects and the potential risk for the rescuers.
- 5.2.4 Sufficient rescue equipment has to be available on site according to the risk assessment. Equipment must meet the requirements of the rescue concept. It must be a separately packed and labelled, ready to use and accessible for all technicians at any time.

6. Application

6.1 Operational planning

Before rope access techniques are used on site, a risk assessment considering all potential hazards has to be completed in order to determine the suitability of the techniques. It is also necessary to determine the appropriate staff and equipment that is required for the safe execution of all work tasks.

As a minimum, the following points have to be verified:

6.1.1 Management and planning

- Assigned rope access supervisor
- Defined number of technicians and assignment of tasks within the team
- Operational instructions and safety standards of the company (for small work sites and small companies, the risk assessment can be included here)
- Documentation of all equipment, tools and materials used on site
- Appropriate insurance of the company and all technicians (employees and sub-contractors). The insurance has to cover personal risks, risks for third parties, especially public traffic and property damage
- A documented safety method statement including risk analysis, risk assessment and monitoring of counter-measures
- Required work permits for all operations
- Requirements for necessary documentation such as the safety logbook, time sheets, accident / incident reports, etc.
- Necessary facilities for the technicians such as sanitary facilities, showers, emergency eye wash fountains, etc.

6.1.2 Selection of anchor points and equipment

- Construction site inspection and selection of anchor points
- Construction site inspection and selection of working techniques and access methods as well as required equipment
- If applicable, test certificates for anchor points and test certificates and load tables for employed hoisting devices

6.1.3 Method of operation

- Proof of deployed methods according to 2.2
- Documentation of emergency and rescue plans and the corresponding responsibilities

6.1.4 Personnel

- For special work tasks and exceptional operations an adapted training for all technicians has to be provided
- Proof of technicians' qualifications

6.2 Risk assessment

6.2.1 When planning rope access operations, all applied methods have to be checked to determine how the existing risks can be eliminated or reduced to an acceptable level. The guidelines of the operational safety regulations and the "Technical Regulation for Work Safety" (TRBS) 1111 (Risk assessment and technical safety evaluation) are relevant documents to refer to.

The following points need special attention:

- Can all material, equipment or tools be used in a safe and easy way?
- Can tools cause any danger to the user in particular?
- Does the selected working technique or access method cause any risk?
- Does any risk occur through the surroundings of the work site?
- Is there a risk of falling materials or equipment during the operation?
- Is it possible to rescue the technician from any conceivable point with the appropriate rescue techniques?
- Can the work endanger third parties?
- Is there any risk caused through third parties?

6.2.2 The process contains 4 steps

Investigation of hazards (so called hazard factors)	Investigation and documentation of all hazards.
Assessment of the ascertained hazards	Risk assessment, if and to what extent the ascertained hazards could lead to an incident or an emergency.
Establish and apply measures based on the results of the risk assessment	An attempt must be made to eliminate or reduce the risk to an acceptable level by implementing appropriate measures.
Efficiency control	It will be check if the applied measures are appropriate and sufficiently effective and that no additional dangers are caused.
Supervision	Additionally the technician, under the direction of the supervisor must continuously check the operations and processes to identify any new dangers.

6.2.3 Availability of documentation

Relevant documentation has to be on hand on site in order to be available for technicians during the operation. The documentation must be produced in a way that not only the technician but also authorities and representatives of the customer can understand it.

6.3 *Selection and qualification of personnel*

6.3.1 Operations have to be planned, supervised and executed by qualified and authorised personnel.

6.3.2 The employer must assign a rope access supervisor for all work. This should be done in a written form and included in the operational logbook. The supervisor has the responsibility for the planning, supervision and safe execution of the work.

6.3.3 Only technicians who passed the appropriate examination and hold a valid Level 3 rope access supervisor certificate can act as supervisors. Supervisors have to be authorized to issue company directives.

6.3.4 Assigned personnel must receive written authorization from the company. This must include authority encompassing the entire area affected by the rope access operations.

6.4 *Restricted areas*

6.4.1 All technicians, especially the supervisor, must create a secure working environment. As part of this process, the supervisor must restrict access to the area around the anchor points and if necessary below the work place. Additional areas subject to access restrictions may include re-belays or additional anchor points and all areas where ropes could be manipulated. In general loose parts, e.g. constructive parts, material, tools and equipment should be secured to prevent them from falling. If the falling of objects cannot be entirely eliminated, the area of danger should be determined and fenced off.

6.4.2 Fall hazard zones should be marked and tagged. They have to be set-up in a way that technicians can attach themselves to the safety system outside the restricted area.

6.4.3 The restricted area must be clearly marked. When necessary additional barriers, marking tape and warning signs can be used to ensure that unauthorised persons cannot enter the area either accidentally or deliberately. When appropriate a safety post can be utilised. Specifically around the anchor points and re-belays, the possibility of manipulation of the system has to be excluded.

7. *Inspection and Examination*

7.1 *Inspection of material and equipment*

7.1.1 Before, during and after each use, the technician should conduct a visual and functional testing of all materials and equipment.

7.1.2 All material and equipment has to be inspected on a regular basis as described in the manufacturer's user instructions and in dependence of it's use. However it must pass an inspection conducted by an expert according to DGUV Principle (DGUV Grundsatz) 312-906 at least once a year. The inspection must be documented. General regulations are described in TRBS 1201 "Inspections" and TRBS 1203 "Authorised Personnel".

- 7.1.3 The employer is responsible that all material and equipment passes an extraordinary inspection conducted by an expert after damage or exceptional incidents.
- 7.1.4 Material, which is not in perfect working condition should be sorted out and labelled immediately, presented to an expert for inspection and retired if necessary.

7.2 Retirement of material and equipment

The manufacturer's specifications on working and shelf life should be followed.

Textile materials should be retired if there is:

- Clearly visible damage to the fibres
- Visible core (for rope)
- Contact with unknown chemicals or acids
- Contact with heat over 60°C
- Stiffening due to use, dirt or overloading

Metal components should be retired if there is:

- Visible damage (notches, cracks, grooves, etc.)
- Abrasion of more than 10%
- Deformation of any kind
- Malfunction of gates, locking mechanisms and other mechanical components

7.3 Examination of rope access technicians and supervisors

- 7.3.1 Every user of rope access techniques must prove to hold at least a valid Level 1 (basic course) certificate. The assessment to achieve the Level 1 qualification must correspond with FISAT's examination guidelines for rope access.
- 7.3.2 Before the execution of horizontal access methods and positioning techniques, a Level 2 examination must be passed. The assessment to achieve the Level 2 qualification must correspond with FISAT's examination guidelines for rope access.
- 7.3.3 Every rope access supervisor must pass a Level 3 examination. The assessment to achieve the Level 3 qualification must correspond with FISAT's examination guidelines for rope access.
- 7.3.4 Every technician has to complete an annual refresher course to renew and deepen theoretical knowledge and practical skills. The practical session includes standard access and positioning techniques as well as rescue skills.

8. Appendices

8.1 Legal foundation / normative references

German Laws and Regulations

ArbSchutzG	Arbeitsschutzgesetz (German Occupational Safety and Health Act)
BetrSichV	Betriebssicherheitsverordnung (Ordinance on Industrial Safety and Health)
GSV	Gerätesicherheitsverordnung (Ordinance on Equipment Safety)
TRBS 2121 Teil 3	Technische Regel für Betriebssicherheit (Technical Regulation for Work Safety)

Directives of the European Parliament and the Council

89/391/EEC	Directive concerning the introduction of measures to encourage improvements in the safety and health of workers at work.
89/392/EEC	Machinery Directive (latest amendment: 2006/42/EC)
89/656/EEC	Directive concerning the minimum health and safety requirements for the use by workers of personal protective equipment at the workplace.
2009/104/EC	Directive concerning the minimum safety and health requirements for the use of work equipment by workers at work.

Regulations of the German Employer's Liability Insurance Association

DGUV Regulation 1	General regulations
DGUV Regulation 17 DGUV Regulation 18	Regulations on event locations (stages and studios)
DGUV Regulation 38 DGUV Regulation 39	Construction sites and construction works
DGUV Regulation 54 DGUV Regulation 55	Winches, Jacks and Hauls

European Standards

DIN EN 12841	Rope adjustment devices
DIN EN 353-1	PFPE; Guided type fall arresters including a rigid anchor line
DIN EN 353-2	PFPE; Guided type fall arresters including a flexible anchor line
DIN EN 341	PFPE; Descender devices for rescue
DIN EN 354	PFPE; Lanyards
DIN EN 355	PFPE; Energy absorbers
DIN EN 358	PFPE; Belts for work positioning and restraint; Restraint systems
DIN EN 359	PFPE; worksite back support systems
DIN EN 360	PFPE; Retractable type fall arresters
DIN EN 361	PFPE; Full body harness
DIN EN 362	PFPE; Connectors
DIN EN 363	PFPE; Personal fall protection systems
DIN EN 364	PFPE; Test methods
DIN EN 365	PFPE ; General requirements for instructions
DIN EN 397	Industrial safety helmets
DIN EN 566	Slings
DIN EN 567	Rope clamps
DIN EN 795	Personal fall protection equipment; Anchor devices
DIN EN 813	PFPE; Sit harnesses and accessories

DIN EN 892	Dynamic climbing rope
DIN EN 892-1	Mountaineering equipment - Dynamic mountaineering ropes; safety requirements, testing
DIN EN 919	Fibre ropes – determination of physical and mechanical properties
DIN EN 958	Mountaineering equipment – energy absorbing systems for use in climbing – safety requirements and test methods
DIN EN 959	Mountaineering equipment – rock anchors
DIN EN 1496	Rescue lifting devices
DIN EN 1497	Rescue harnesses
DIN EN 1808	Suspended Access Equipment
DIN EN 1891	PFPE – low stretch kernmantel ropes
DIN EN 4426	Testing of anchor points
DIN EN 12275	Mountaineering equipment: connectors
DIN EN 12277	Harnesses
DIN EN 12841:2006	Rope adjustment devices

National Standards

DIN 7478-B	Safety harnesses for mining
DIN 7947	Ascent harnesses
DIN 15003	Hoists; Load bearing devices, Load and force, definitions
DIN 32915	Accessory Cord
DIN 4426	Accessory Cord

Rules, Information and Principles published by the German Employer's Liability Insurance Association (DGUV)

DGUV Rule 101-005 DGUV Rule 101-006	Rules for high level personal suspension means
DGUV Rule 109-006	Rules for the use of fibre ropes
DGUV Rule 112-198	Rules for the use of PFPE to prevent falls
DGUV Rule 112-199	Rules for the use of PFPE for rescues
DGUV Inf. 201-001	Information on tower and chimney construction
DGUV Inf. 201-018	Information on manually operated work seats
DGUV Inf. 204-006	Information on procedural guidelines for first aid
DGUV Inf. 204-022	Information on first aid in the company
DGUV Inf. 209-075	Information on work equipment for lifting of persons
DGUV Inf. 209-021	Load tables for anchor devices
DGUV Inf. 211-010	Safety through operating instructions
DGUV Inf. 211-032	Assessments of hazards and stresses in the workplace
DGUV Inf. 250-449	Instructions for preventive medical examinations: Work at height
DGUV Principle 312-906	Principles for the selection, training and certification of experts for personal fall protection equipment

8.2 Charts

8.2.1 Safety area radius

Radius of the safety area below the work place:

Respective maximum working height H (meters)	Required radius related to working height	Minimum radius of safety area in meters
Working height below 100 m	H/5	12,50
Working height 100 to 150 m	H/6	20,00
Working height 150 to 200 m	H/7	25,00
Working height over 200 m	H/8	30,00

Source: DGUV Information 201-001

These minimum radii are recommendations and should be verified in relation to the object.

8.2.2 Wind force

Wind force according to the Beaufort Scale

Wind strength Beaufort Scale	Description	m/s	km/h	Wind conditions	Dynamic Pressure in kg/m ²
0	Calm	under 0,3	under 1	Calm. Smoke rises vertically	0
1	Light air	0,3-1,5	1-5	Smoke drift indicates wind direction and wind vanes cease moving.	0-0,1
2	Light breeze	1,6-3,3	6-11	Leaves rustle and wind vanes begin to move. Wind felt on exposed skin.	0,2-0,6
3	Gentle breeze	3,4-5,4	12-19	Leaves and small twigs constantly moving, light flags extended.	0,7-1,8
4	Moderate breeze	5,5-7,9	20-28	Dust and loose paper raised. Small branches begin to move.	1,9-3,9
5	Fresh breeze	8-10,7	29-38	Small trees in leaf begin to sway. Many whitecaps. Wind uncomfortable on exposed skin.	4,0-7,2
6	Strong breeze	10,8-13,8	39-49	Large branches in motion. Whistling heard in overhead wires. Umbrella use becomes difficult.	7,3-11,9
7	High wind	13,9-17,1	50-61	Whole trees in motion. Effort needed to walk against wind.	12,0-18,3
8	Gale	17,2-20,7	62-74	Some twigs broken from trees. Progress on foot seriously impeded.	18,4-26,8
9	Strong gale	20,8-24,4	75-88	Minor damage to buildings, chimney caps and roof tiles blown off.	26,9-37,3
10	Storm	24,5-28,4	89-102	Trees are broken or uprooted. Significant damage to buildings.	37,4-50,5
11	Violent storm	28,5-32,6	103-117	Very rare inland. Severe storm damage.	50,6-60,6
12	Hurricane	32,7 and above	118 and above	Massive devastation at sea, on the coast and in the mountains, extremely rare inland.	66,7 and above

Risk Assessment Wind Speed

Use of Rope Access Techniques				Installation of giant poster (dynamic pressure is related to the surface area)				
Wind Strength (Beaufort)	m/s	Km/h	Knots	Risk Assessment	Dynamic Pressure kg/m ²	Dynamic Pressure 300 m ² /kg	Dynamic Pressure 500 m ² /kg	Risk Assessment Signage Installation
0	0-0,2	under 1	1	Safe Range Work can be carried out, no danger due to wind	0	0	0	Safe Range Giant poster installation can be carried out
1	0,3-1,5	1-5	1-3		0-0,1	30	50	
2	1,5-3,3	6-11	4-6		0,2-0,6	180	300	
3	3,4-5,4	12-19	7-10		0,7-1,8	540	900	
4	5,5-7,9	20-28	11-15	Range with Risk: Work with appropriate safety measures with attention to the risk	1,9-3,9	1170	1950	Range with Risk: Work with appropriate safety measures with attention to the risk
5	8-10,7	29-38	16-21		4,0-7,2	2160	3600	
6	10,8-13,8	39-49	22-27	Dangerous Range Work is suspended No personnel in danger area Removal of all materials	Maximum for rope access: 30 Knots, 15 m/s, 56 km/h			Dangerous Range Work is suspended No personnel in hazardous area Removal of all material
7	13,9-17,1	50-61	28-33		7,3-11,9	3570	5950	
8	17,2-20,7	62-74	34-40		12,0-18,3	5490	9150	
9	20,8-24,4	75-88	41-47		18,4-26,8	8580	13400	
10	24,5-28,4	89-102	48-55		26,9-37,3	11190	18650	
11	28,5-32,6	103-117	56-63		37,4-50,5	15150	25250	
12	32,7-36,9	117-133	64-71		50,6-60,6	18180	30300	
				66,7 +	20010	33350		

Factors such as the object height, wind direction, type of work and rope length must be considered. In certain circumstances, danger can arise under light winds as the dynamic pressure is related to the surface area. All information is provided without any guarantee, the user accepts complete responsibility for all risks and any resulting property damage, personal injuries or deaths that may occur during or following the inappropriate application of this data.