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2 OHS Training Level 1

2.1 Training Output

The worker is properly instructed in use and maintenance of the personal protective equipment (further referred to as PPE) for work at heights. He can safely use fall arrest systems and work positioning systems other than rope access (work in hanging position). He can set up a basic fall arrest system and knows the rules for selecting anchor points.

2.2 Theoretical part - Legislation

2.2.1 Act No. 262/2006 as amended

Duties of the Employer:

- ensure for the employees (...) with regard to the type of work performed by them, to be provided with sufficient and adequate information and guidelines on occupational safety and health protection in accordance with this Code and other statutory provisions (Note 32), especially by making them aware of the relevant risks, results of risk assessment and preventive measures against such risks relating to their type of work and workplace;
- ensure that another employer's employees performing work at his workplaces are provided with suitable and adequate information and guidelines on occupational safety and health protection and on relevant measures, in particular those concerning getting a fire under control, providing first aid and evacuating individuals (natural persons) in case of contingencies (extraordinary events)
- ensure staff training (i.e. staff receiving instruction) on statutory provisions and other regulations on occupational safety and health protection, the knowledge of which supplements the employees vocational prerequisites for performance of the type of work they are engaged in and which relate to risks that the employees may encounter at workplaces where their work is carried out; the employer shall systematically require and check observance of the said statutory provisions and other regulations.
- determine content and frequency of staff training regarding the statutory provisions and other regulations with the view of safeguarding occupational safety and health protection at work, the manner of checking the employees' knowledge (of the said statutory provisions and other regulations) and the keeping of records of (documentation on) such staff trainings. Where the nature of the risk involved or its gravity so requires, the staff training according to the first sentence must be regularly repeated.

2.2.2 Government Decree No. 362/2005 on detailed requirements regarding safety and protection of health at workplaces with a risk of falling from a height

- § 1-5
- Annex to Government Decree No. 362/2005 Coll.
 - I. Fall protection by a technical structure
 - II. Fall protection by personal protective equipment (hereinafter referred to as PPE)
 - III. The use of ladders
 - IV. Securing the materials against falling.
 - V. Securing the area under the place of work at heights and its surroundings
 - VI. Working on roofs
 - VII. Temporary construction structures
 - VIII. Dropping objects and material.
 - IX. Interrupting work at heights
 - X. Short-term works at heights
 - XI. Staff training

2.2.3 Government Decree No. 495/2001 Coll., establishing the extent and detailed conditions for the provision of personal protective equipment

- § 2-5
- Annex No. 2 to Government Decree No. 495/2001 Coll.
 - Head protection equipment
 - Fall protection equipment
- Annex No. 3 to Government Decree No. 495/2001 Coll.
 1. Works and activities which require using head and skull protection - protective helmets
 9. Works and activities which require using safety belts
 10. Works and activities which require using safety ropes

2.2.4 Act No. 309/2006 Coll. stipulating further requirements for health and safety at work, as amended

- § 3 Requirements concerning the Workplace and the Working Environment on Construction Sites
- § 5 Requirements concerning the Organization of Work and Working Procedures against Falling from a Height, 1, c)
- § 6 Safety Signs, Signboards, Communication
- §12,13 Providing Occupational Health and Safety Protection in Activities or Services Provided outside Labour Relations
- § 16,17 Obligations of the contractor or other natural person to the OSH coordinator

2.2.5 Government Decree No. 101/2005 Coll., on detailed requirements for workplaces and working environment,

Annex: Other detailed requirements for workplaces and working environment

- 3.2.3 Unprotected holes in walls and partitions
- 3.3.4 Safe access to the workplace
- 3.3.5 Railings at workplaces and roads
- 5.6 Fall protection structures on grid bridges, footbridges, staircases, galleries
- 5.8 Fall protection on uncovered liquid tanks
- 5.9 Fall protection on non-passable and non-crossable reservoirs
- 5.10 Fall protection on stairway flights and midway landings
- 5.21 Dangerous area with a risk of employees or objects falling into this space
- 6.1,6.2 Manoeuvring space of the loading and unloading ramp
- 7.5 Fall protection signs next to an open pit
- 9.4 Outdoor workplace and protection against falling objects

2.2.6 Government Decree No. 361/2007 Coll., laying down conditions for the protection of health at work

- § 3-5 Hazard due to heat, long-term and short term acceptable outdoor work, minimal health protection measures, safety breaks
- § 6, 7 Hazard due to cold at the outdoor workplace and minimal health protection measures
- § 8 Protective drinks against hazards due to cold and heat

2.2.7 Decree No. 79/2013 Coll., on occupational health services

- § 11 Periodic Medical Examinations
- Annex No. 2 Part II Health Risks - Working at Heights of more than 10 Meters Using the PPE Against Fall

2.2.8 Regulation (EC) No. 1272/2008 on classification, labelling and packaging of substances and mixtures (CLP)

- Hazard pictograms, signal words
- Safety data sheet

2.2.9 Government Decree No. 180/2015 Coll., on forbidden works and workplaces

- § 5, par. 2 works at heights prohibited for juvenile employees

2.2.10 Act No. 251/2005 Coll., on Labour Inspection, as amended

- § 7 Right of an inspector to issue a decision prohibiting the performance of work or activities

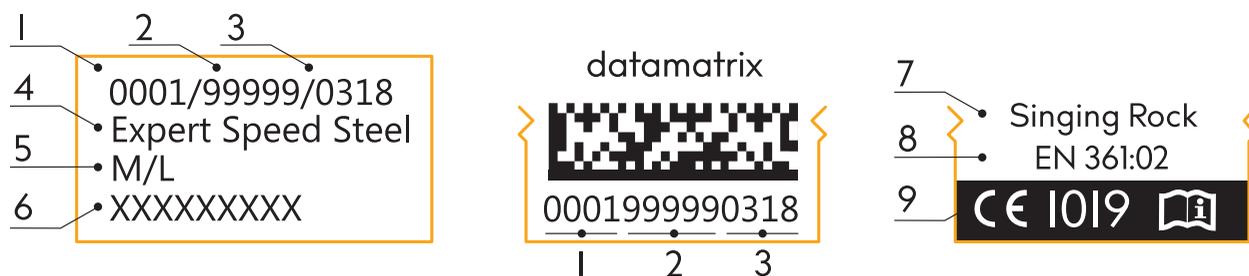
2.2.11 ČSN EN 363, issued in September 2008, Personal fall protection equipment - Personal fall protection systems

Theoretical Part – Introduction to the Equipment

2.2.12 Identification of a Product and Equipment Marking

Name of the Manufacturer of the Product

is important if the product documentation is not available, so that the manufacturer can be asked to provide the documentation or additional information in case the information in the Instructions for use is insufficient.



1 unique number

2 batch number

3 month /
year of manufacture

4 model

5 size

6 product code

7 producer

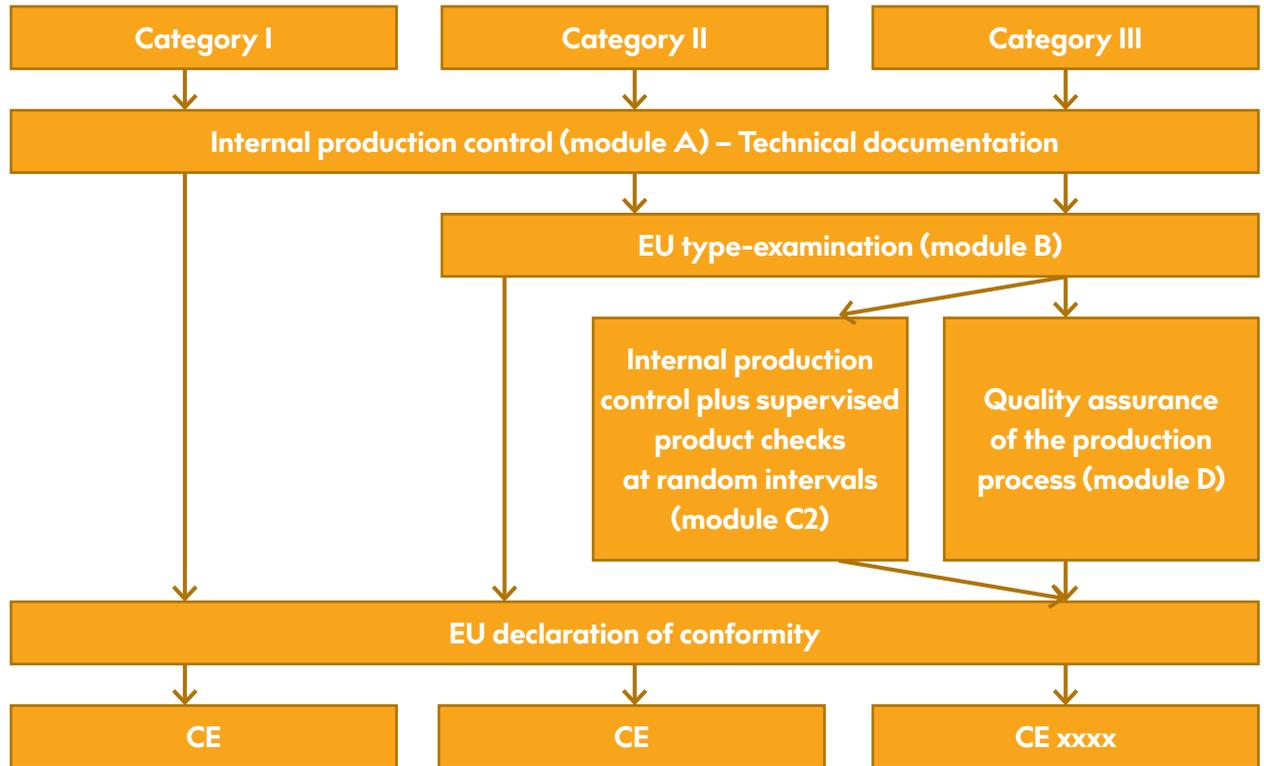
8 european standard

9 conformity mark /
no. of notified body



The CE marking is an expression of compliance with all the requirements on the manufacturer concerning their product based on the European directives. The CE marking on the product is a declaration by a natural or legal person that the product complies with all applicable regulations and has undergone all due conformity assessment procedures.

PPE are divided into three categories according to the hazards associated with their usage. The first category consists of the PPE associated with low level of risk, such as protective glasses, gloves etc. The second category consists of the PPE associated with higher risk, such as helmets. These two PPE categories are only marked with the CE logo. The PPE of the third category is the equipment whose failure involves a risk of death. These products are marked with CE XXXX, where 4 digits indicate a notified body, which guarantees that the manufacturing process does not change over the years. The manufacturers of this equipment undergo an annual inspection either based on internal production control plus supervised product checks at random intervals or based on quality assurance of the production process



Further information could be found in REGULATION (EU) 2016/425 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 9 March 2016 on personal protective equipment, which repeals Council Directive 89/686/EEC

All PPE must be marked with the CE marking according to REGULATION (EU) 2016/425. If the equipment does not contain CE marking, it is not a PPE.

EN norm

The norms state the requirements for a product, a process or a service to be suitable for a given purpose under specific conditions. They establish the essential requirements for quality, safety, compatibility, interchangeability, health and environmental protection.

EN is a harmonized or non-harmonized to some EU directives or regulations European norm created either by European standardization authorities based on the requirements of the European Commission, or subsequently selected from the existing European norms and recognized as a standard supporting the essential requirements of the so-called new approach. The directives and regulations of the new approach stipulate mainly the requirements for safety of the products entering European Union's internal market. Fulfilling the requirements of the harmonized European norm forms a prerequisite for compliance with essential requirements of these legislation documents. Therefore, a businessman can use a harmonized standard, and if (s)he meets its requirements, (s)he is deemed to have met the requirements of the relevant EU legislation.

EN STANDARD NUMBER	EN STANDARD NAME
ČSN EN 131-1+A1	Ladders – Part 1: Terms, types, functional sizes
ČSN EN 131-2+A1	Ladders – Part 2: Requirements, testing, marking
ČSN EN 131-3	Ladders – Part 3: User Instructions.
ČSN EN 131-6	Ladders – Part 6: Telescopic ladders
ČSN 74 3282	Ladders – article 5.10
ČSN EN 341	Personal fall protection equipment - Descender devices for rescue
ČSN EN 353-1	Personal protective equipment against falls from a height - Part 1: Guided type fall arresters including a rigid anchor line
ČSN EN 353-2	Personal protective equipment against falls from a height - Part 2: Guided type fall arresters including a flexible anchor line
ČSN EN 354	Personal protective equipment against falls from a height – Lanyards
ČSN EN 358	Personal protective equipment for work positioning and prevention of falls from a height - Belts for work positioning and restraint and work positioning lanyards
ČSN EN 360	Personal protective equipment against falls from a height - Retractable type fall arresters
ČSN EN 361	Personal protective equipment against falls from a height – Full body harnesses
ČSN EN 362	Personal protective equipment against falls from a height - Connectors
ČSN EN 363	Personal fall protection equipment - Personal fall protection systems
ČSN EN 365	Personal protective equipment against falls from a height - General requirements for instructions for use, maintenance, periodic examination, repair, marking and packaging
ČSN EN 795	Protection against falls from a height - Anchor devices
ČSN EN 813	Personal protective equipment against falls from a height– Sit harnesses
ČSN EN 1496	Personal protective equipment against falls from a height – Rescue lifting devices
ČSN EN 1497	Protection against falls from a height - Rescue harnesses
ČSN EN 1498	Protection against falls from a height - Rescue loops
ČSN EN 1868	Personal protective equipment against falls from a height - List of equivalent terms
ČSN EN 1891	Personal protective equipment for the prevention of falls from a height - Low stretch kernmantle ropes
ČSN EN 12841	Personal fall protection equipment - Rope access systems - Rope adjustment devices

Some of the norms are not harmonized to any directives and regulations. In this case we are not talking about PPE though – see for example EVACUATION TRIANGLE SIT II, certified according to EN 1498.

It is not obligatory to follow EN norms for obtaining EU type examination certificate– see for example RIGGING PLATE or FLASH ACCESS helmet. Products marked with CE and without any EN norms can be still considered as PPE.



The open book symbol with letter „i“ on the product emphasizes the user’s obligation to read the Instruction for use prior to the use of the product.

MBS (minimum breaking strength) stated on the product is the limit force needed for damage. This value determines when the product cracks. The value is in kN, in whole numbers (rounded down). Used for calculation of MBL.

MBL (minimum breaking load), the limit load based on MBS, for the purposes of transferring the units lkn corresponds to 100 kg (i.e. if MBS is 22kN, then MBL is 2200 kg)

F – (safety factor) the safety coefficient – 10 for textile, 5 for metal

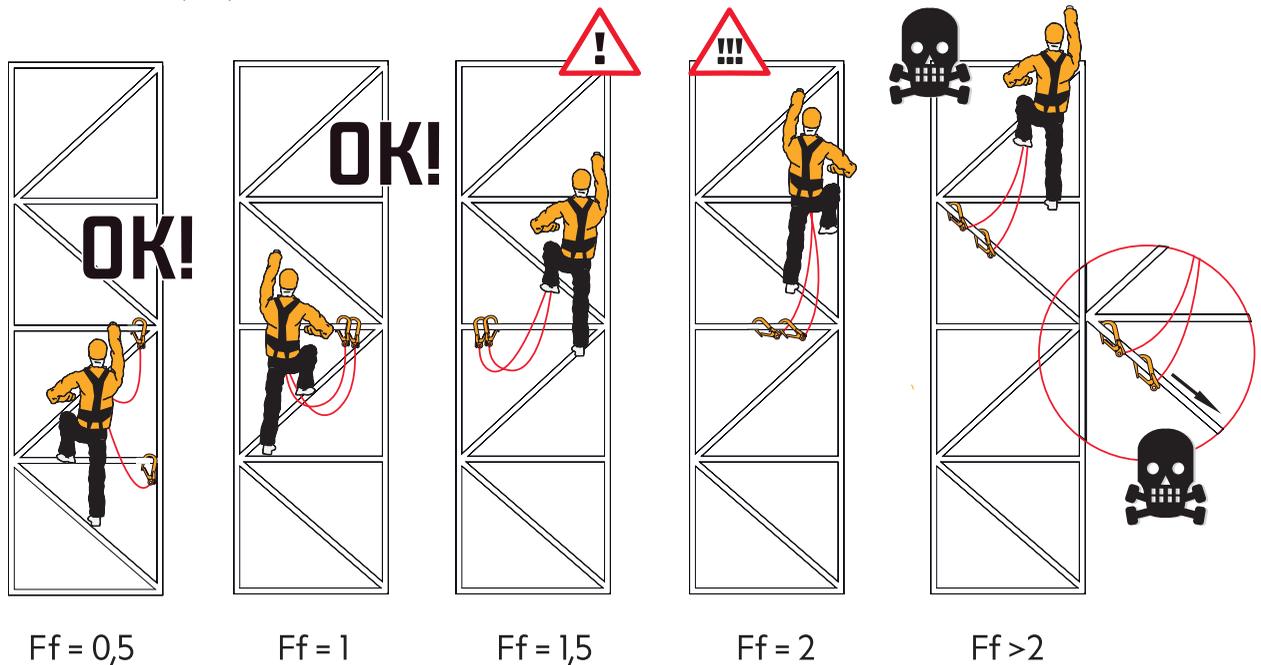
SWL – safe working load is calculated based on the formula

$$SWL = MBL / F$$

WLL – (working load limit) the maximum working load replaces SWL for the devices for which SWL cannot be calculated. It is specified by the manufacturer. (For example, for the descenders.)

If the product is loaded with SWL, there is no risk of damage, not even due to long-term use. (By using SWL we give the system a conscious reserve for an unexpected overload.)

Fall Factor (FF)



Fall factor is a dimensionless number. With its increasing value the degree of risk for the worker increases. We calculate the fall factor based in the formula

$$FF = \text{length of the fall} / \text{length of the active fall arrest system}$$

In general, the risk is minimized if we work with the lowest fall factor possible, using the shortest possible fall arrest system.

Date of Manufacture

The lifetime of the product is specified by the manufacturer in the Instructions for use. The lifetime period starts with the date of manufacture, or the date of the first use (if recorded). This applies in particular to textile products and products made of plastic. (The lifetime of the product is stated in the Instructions for use. Check the date of manufacture prior to purchasing the product.)

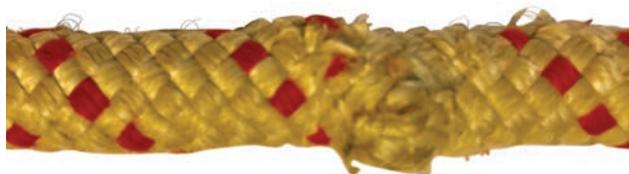
2.2.13 Equipment Inspection



As the failure of the PPE for work at heights can cause severe injuries or death, it is essential to carry out the inspections of this equipment on regular basis. According to the EN 365 standard this inspection should be carried out by a competent person (PPE inspection technician) at least once in every 12 months. However, as this inspection does not have to be sufficient, a brief user check before every use is required.

Textile Equipment

Visual, tactile and olfactory inspection of ropes and straps must be carried out before storage as well as before use. With the kernmantle ropes the tactile inspection is carried out by running the rope through hands in order to feel any deformation of both core and sheath, and simultaneous visual checking for signs of cutting, abrasion, bulging etc. The equipment with straps must be checked for incisions, tearing, abrasion, broken threads, chemical contamination and broken fibres (which indicate that the product has been overloaded).



Abrasion is the most common cause of loss of strength of textile equipment. It is often caused by rubbing the equipment against sharp, coarse edges or other components. Another important cause of abrasion, which is often neglected, is dirt or sand penetrating into the fabric or the inner core of the product and damaging the inner thread. This causes loss of strength, even though it may not be easily detected in the early stages.

Mechanical damage, for example the damage caused by a falling rock, also has a negative effect on the textile equipment, and the loss of strength is directly proportional to the severity of the damage.



Overloading or impact loading weakens ropes and straps, and this weakening is proportional to the load to which the fabric is exposed. The ropes and straps that have been exposed to heavy loads should be retired immediately. This must be done in a way that prevents their further use.



Chemical damage to textiles is often difficult to detect until the rope or strap begins to fall apart and therefore can be overlooked during the inspection. It may be indicated by white powder residue on the surface of the fabric or a significant change in texture. foto chemické poškození
Any fabrics exposed to chemical contamination should be immediately retired. The information on the effects of certain chemicals on the fabric can be obtained from the manufacturer of the equipment. In case of doubt stop using the equipment and destroy it, so that it cannot be used any longer.

Note:

Polyester is more acid resistant than nylon. Nylon is more resistant to bases than polyester.



The textile equipment that has burnt or glossy surface, foto spálený textil could have been exposed to high temperatures, either by contact with a hot surface or as a result of friction with the descending device or by mutual friction of two fabrics.

All these causes of damage have negative impact on the strength of the equipment – from a minor loss of strength to a broken strap.

It is necessary to protect the ropes and straps against high temperatures, because the character, and hence the performance, of most of the artificial textiles change at temperatures above 50°C.

Cleaning and Maintenance: In order to reduce the possibility of abrasion by dirt the fabrics can be washed in clean water with maximum temperature 30 °C.



washing



drying



beware of salt



beware of UV



beware of chemicals



read instruction

If the textile is particularly dirty, a suitable detergent such as soap flakes or fine detergent (pH 5.5 to 8.5) may be used. After washing the fabric should be thoroughly rinsed in cold water. When machine washing the textiles, it is recommended to put the equipment into a bag to protect it against mechanical damage. Do not use high-pressure hoses. The equipment should be dried and rinsed in a well-ventilated room out of the reach of direct heat and sunlight. Always follow the manufacturer's instructions for care and maintenance.

The textiles that have been exposed to rust should be washed. The textiles with permanent rust stains should be considered potentially dangerous and should be retired. The tests show that rust has a weakening effect on polyamides.



Metal Equipment

Metal equipment, such as connectors, maillons, ascenders, descenders and buckles on harnesses must be inspected in order to ensure that their mechanical function is not disturbed in any way. Check whether the springs, hinges and threads are properly functioning and that the rivets and connections are solid. The equipment should be checked for signs of deformation, wear, cracks or other deviations from the standard.

For the equipment with movable parts check whether these parts are functioning properly. The equipment must be kept clean and dry and all the moving parts (except for those which may come into contact with textile equipment) must be lubricated by a silicone-based lubricant.

Any defective piece should be retired immediately.

The metal equipment may have an extensive internal damage which may not be visible. This is often caused by incorrect use and care of this equipment, for example by a fall or overloading the equipment etc. and it may result in a catastrophic failure without prior warning. Therefore, it is essential to give the metal equipment proper care and maintenance.

Cleaning and Maintenance: Metal equipment can be cleaned by soaking in hot clean water (max. 100 C) and by using soap or detergent which

should be then carefully washed off. A scrubbing sponge or brush may be used. These should be made of a material other than metal, such as nylon. Always follow the manufacturer's instructions for care and maintenance.

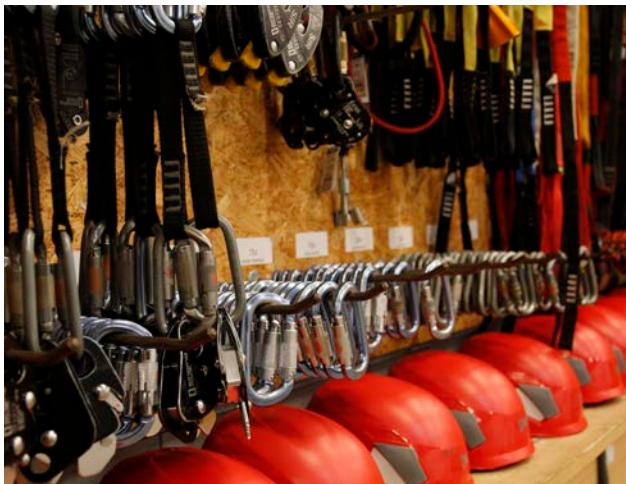


Helmets

Inspect the inner and outer surface of the shell for signs of wear, cracks, burned spots, deformations and signs of chemicals.

Check the condition of the attachment mechanism. Check if it holds firmly and there are not any torn places, loose stitches etc. Check if all the adjustable parts are fully functional, do not slip and are not damaged or worn,

Cleaning and Maintenance: Helmets can be washed in clean water with maximum temperature 30 °C. Do not use high-pressure hoses. Use soap or a detergent for fine fabrics for washing of the straps. Let the helmet dry in a cool, dark and well-ventilated place. Denatured alcohol may be used to remove the adhesive residues (such as stickers).



Storage of the Equipment

The equipment must be stored in safe environment, which is accessible to competent staff only.

After cleaning the equipment, dry it, treat it and inspect it according to the instructions from the manufacturer. The equipment should be stored in a dry, well ventilated environment away from direct sunlight and other sources of heat, and any chemical contaminants. At the workplace the ropes and other equipment should be stored free, in packaging and in a safe place to reduce the risk of chemical or mechanical damage.

If the ropes are to be coiled, take into account the size and handling of the coil and possible double coiling or tying up the knots in advance to facilitate handling the rope.

During coiling the rope should not twist and during uncoiling it should not tangle up. A new standard 50m rope, coiled and secured with straps from the manufacturer, should be uncoiled by two workers in order to prevent tangling up. When unwinding the rope right from the spool, place the unwound rope on a protective pad. Once the rope is cut and marked it can be coiled according to its future function.

2.2.14 Before Commencing the Work

Prior to commencement of the work supervision must be provided. The level of supervision must be adequate to the work situation from the point of view of the number of supervised workers and the level of their skills with regard to their tasks.

The supervisors' job is to ensure that the work is carried out in accordance with the outline of the safe methods in order to prevent injuries, waste of material and faulty work. Before starting to work any team member who have not worked in heights for a long time must undergo a training of an appropriate level. Newly qualified workers must be under direct supervision of an experienced worker until they are deemed to be able to work independently. If there are more independent work areas in the workplace it is important to ensure that all the working areas have a sufficient level of supervision, in general 1 supervisor to 4 workers at most. In larger workplaces where a direct communication may be difficult, providing means of communication and instruction on how to use them correctly should be considered. Prior to use of walkie-talkies a permission must be granted by the supervisor. The work teams should have at least two members, one of whom is competent to carry out the supervision.

Documentation to be completed by a Responsible Person prior to the commencement of the work:

Specification of the Workplace/ Contacts

This document must contain an exact location of the workplace and the address. The company or person for whom the work is being carried out should also be included, including the contact persons at the workplace. The document must be signed by all the relevant persons so that the work is not carried out without the knowledge of the contracting authority and the OSH coordinator.

Technological Procedure and a Way of Communication

This part contains an accurate description of the work procedure, way of ensuring safety of the individuals, including the specification of the anchor points. The way of communication is also included.

List of Equipment and Periodical Inspection Protocol

List of the used equipment and a valid Periodical Inspection Protocol.

All workers confirm that they know how to use the listed equipment and are familiar with the Instructions for use.

Climatic Conditions

Analysis of the current climatic conditions at the time and place of the work.

Risk Analysis

Analysis of the risks at the workplace, including the measures to minimize these. Using the risk assessment table, we adopt measures to reduce risks to the lowest possible level. In case the estimated level of risk stays high even after adopting the measures to reduce it the work cannot be started.

Risk Matrix			Potential Consequences				
			L6	L5	L4	L3	L2
			Minor injuries or discomfort. No medical treatment or measureable physical effects.	Injuries or illness requiring medical treatment. Temporary impairment.	Injuries or illness requiring hospital admission	Injuries or illness resulting in permanent impairment	Fatality
			Not Significant	Minor	Moderate	Major	Severe
Likelihood	Expected to occur regularly under normal circumstances	Almost Certain	Medium	High	Very High	Very High	Very High
	Expected to occur at some time	Likely	Medium	High	High	Very High	Very High
	May occur at some time	Possible	Low	Medium	High	High	Very High
	Not likely to occur in normal circumstances	Unlikely	Low	Low	Medium	Medium	High
	Could happen, but probably never will	Rare	Low	Low	Low	Low	Medium

Evacuation Plan

The plan describing the procedure of rescuing all the workers if evacuation is needed. (persons responsible for the evacuation, placement of the evacuation kits etc.)

Rescue Plan

The document contains the list of persons who have the first aid training (and are responsible for its implementation), the location of the first aid kits, contact for the Integrated Rescue System, contact for the person responsible for the shutdown of pipelines and energies.

List of Conflicting Operations

The document describes the conditions under which collaboration with other staff outside the working group will be needed. A potential necessity to interrupt work or adopt other measures.

- Cooperation with crane operators, platform operators, helicopter pilots etc.
- Interruption of work during concreting, welding, demolition etc.
- All the workers and persons listed above must be demonstrably familiar with the above listed documents.

2.3 Practical part

2.3.1 Personal fall protection system

Workers at height are in permanent danger of falling from a height. That is why their safety should always come first. Worker's safety is achieved by using various methods for setting up a personal fall protection system. The structure of the fall protection system should always correspond with the type of activity considering high efficiency of work along with the maximal possible safety.

Personal fall protection systems protect user against falls from a height by either preventing or arresting free falls. They include:

- **Restraint system** – personal fall protection system which prevents the user from reaching zones where the risk of a fall from a height exists.
- **Work positioning system** – personal fall protection system which enables the user to work in tension or suspension in such a way that a free fall is prevented.
- **Rope access system** – personal fall protection system which enables the user to get to and from the place of work in such a way that a free fall is prevented or arrested, by using a working line and a safety line, separately connected to reliable anchor points.
- **Fall arrest system** – personal fall protection system which limits the impact force on the body of the user during fall arrest
- **Rescue system** – personal fall protection system by which a person can rescue themselves or others, in such a way that a free fall is prevented.

A personal fall protection system includes a body holding device which is attached to a reliable anchorage point via an attachment system, which consists of one or more components that are normally include in the system in accordance with its intended use (e.g. lanyards, connectors, fall arresters, anchor devices).

2.3.2 Communication during the Use of PPE when Working at Heights

Communication rules should be agreed before starting working activities. For example, “Watch Out!” or “Head!” means that there is a risk of falling objects; “Rope!” means that a rigger is throwing a free end of the rope to a working area.

2.3.3 Securing the Workplace

If the worker’s activity endangers other person/s, he bears the responsibility. Therefore, as a part of the preparation for work, the workplace must be secured. For the short-term activities it is possible to secure the workplace with barriers, in other cases we can use two-bar railings or apply more effective measures (See Government Decree No. 362/2005 Coll.)

To safely secure the dangerous areas the following measures in particular may be applied:

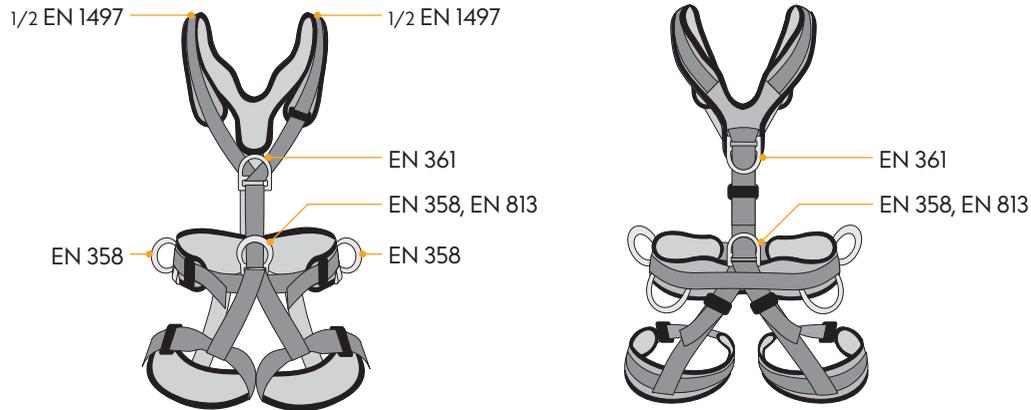
- a. Eliminating the traffic (closing the road – marking the appropriate alternate route)
- b. Constructing a structure for protection against the fall of persons and objects at the level of the place of work at heights or under the place of work at heights (nets, underpasses, covers)
- c. Installation of double-rail railings with height of at least 1.1 m in the dangerous areas, with rails mounted on balusters with sufficient stability; for works not exceeding one working shift, it is sufficient to define the dangerous area by a single-rail handrail, or a barrier at least 1.1 m high, or
- d. provide surveillance of the dangerous areas by a designated employee throughout the duration of the danger.

The width of the dangerous area from the free edge of the workplace must be at least:

- a. 1,5 m for work at heights from 3 m to 10 m,
- b. 2 m for work at heights from 10 m to 20 m,
- c. 2,5m for work at heights from 20 m to 30 m,
- d. 1/10 of the height of the object for work at heights of more than 30 m.

(When working on surfaces with a gradient of more than 25 degrees from the horizontal surface, the width of the dangerous area increases by 0.5 m. Similarly, this width is increased by 1 m on all sides from the vertical profile of the vertically transported load at the material transport points)

2.3.4 Putting on and Adjusting the Harnesses



Adjust a loose harness according to the size of the body and tighten. (Test of the length adjustment – the harness allows to raise hands upwards. The circumference length adjustment test: a palm – but not a tight fist – can be inserted under the strap.) The loose ends of the straps are folded so that they do not hinder. Buddy check in pairs follows, with emphasis on the back of the harness which the user cannot see by himself. We do not settle for a visual inspection only.

	 Rear A	 Chest A	 Front Central	 Side
Work restraint	•••	••	••	•
Fall arrest (SRL fall absorber)	•••	••		
Fall arrest (structures climbing)	••	•••		
Work positioning		•	•••	•••
Lead climbing		•••		
Rope access			•••	
Rescue			•••	

• Suitable but not practicle •• Suitable ••• Ideal

2.3.5 Setting up the Fall Arrest System

In order to secure a worker we use the anchor points with a sufficient resistance in the direction of the load in accordance to the Government Decree 362/2005. General value applied to fall arrest is 15 kN.

Rope with a sewed eye



The rope with a sewed eye reduces the possibility of an error resulting from an incorrect tying of a knot and should be therefore used as a first option for anchoring, unless there are other risks associated with using it (such as the sewed eye getting caught while pulling the rope down.)

Basic knots

We must keep in mind that any knot tied on rope decreases its strength. A safe knot must be easy to read and properly tightened.

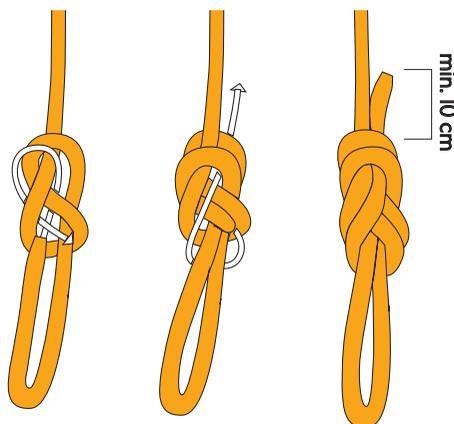


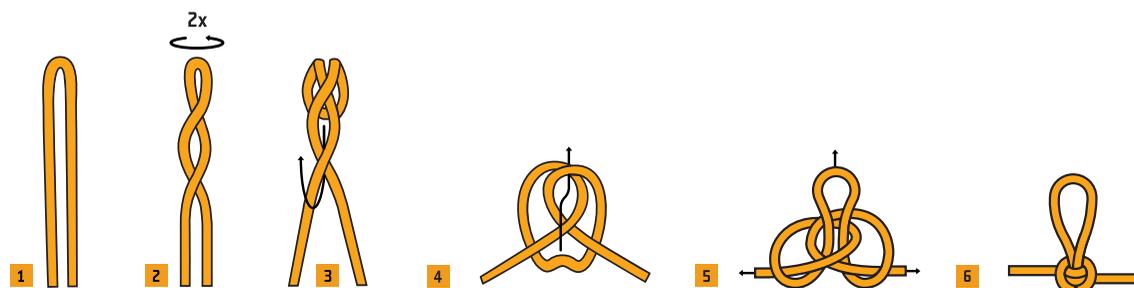
Figure-eight follow through knot

Used for anchoring and attaching the rope, joining two ropes. (it is a knot tied at the end of the rope)
The correctly tied Figure-eight follow through knot is arranged so that the individual strands of the knot do not cross each other but pass through the entire knot in parallel.

We tie the knot so that the length of the loose end of the rope corresponds to ten times the diameter of the rope.

Figure-eight follow through knot reduces the strength of the rope by 23 – 34 %

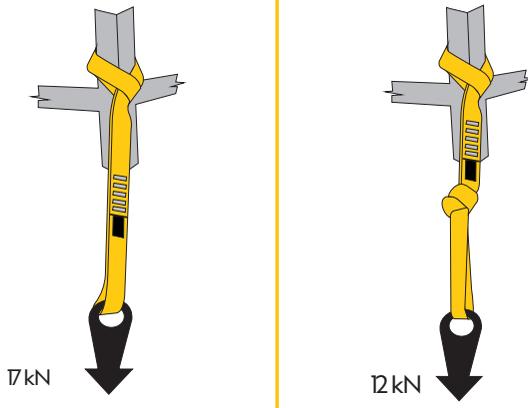
Alpine butterfly



Used for anchoring in the middle of the rope, two-point anchoring (Y-hang), protecting the rope (bypass) with a steel sling, isolating a damaged part of the rope. (it is a mid-rope knot)

Alpine butterfly reduces the strength of the rope by 28 – 39 %

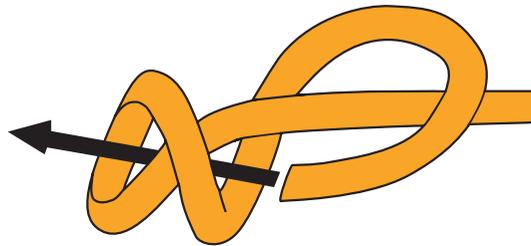
Cow hitch and Prusik knot



Used for anchoring on vertical structures, ropes and columns. It prevents undesired shifting of the anchor device.

Cow hitch, incorrectly used, can reduce the strength of the rope by up to 50%.

Increased probability of damage to the anchoring equipment at the anchoring place must be taken into consideration.



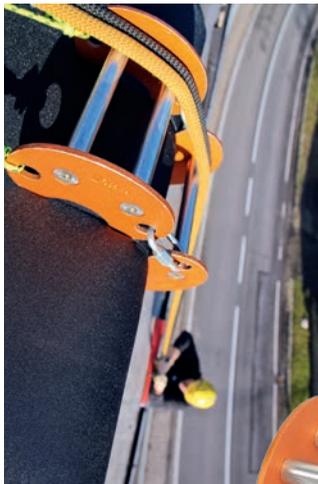
Barrel knot

Ends the loose end of the rope so that it does not slip out of the belay or descending device.

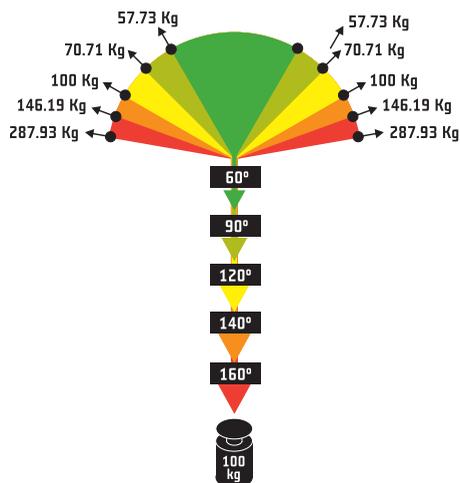
Reduces the strength of the rope by 23 – 33%.

The loose end of the rope behind the knot should be at least 30 cm long.

2.3.6 Sharp Edges and Placing the Anchor Devices



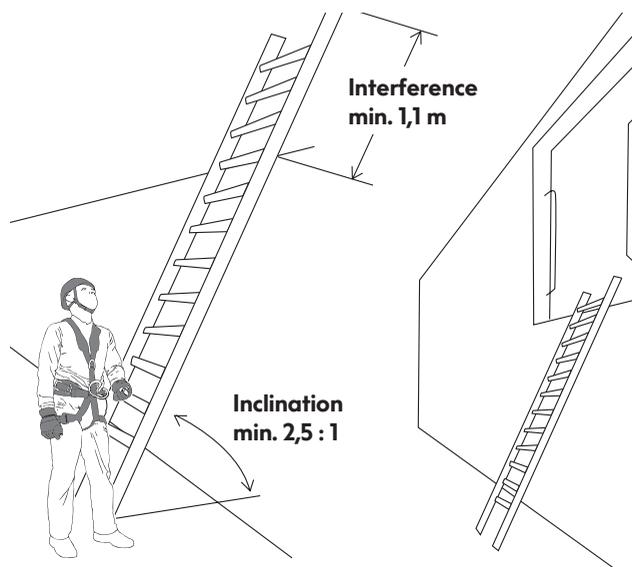
If the anchoring equipment comes into contact with a sharp edge, there is a risk of damage, therefore the anchoring equipment must be protected. A simplified definition of sharp edge is: an edge with a sharper radius than rope passing through a carabiner. If the rope or flat sling passes over an edge sharper than 90°, it is recommended to use a protection made of hard material (like an edge roller), in cases where the edge is less sharp, it is possible to use protection made of soft material (such as a rope protector)



Y-hang

If we have doubts about the condition and bearing capacity of an anchor point, we make a so-called Y-hang, i.e. we distribute the load among more anchor points so that the resulting bearing capacity fulfils the requirement of 15 kN.

The force diagram shows that setting up a Y-hang makes sense if the angle between the two branches of the rope is less than 120°, preferably less than 60°. We can easily achieve this with a combination of the figure-eight knot and Alpine butterfly.



2.3.7 Ladders

We use ladders for easy and short-term work and make safety breaks on regular basis. When working with higher ladders, their weight and the possibility of dropping the ladder from the vertical position must be taken into account. At least two competent persons must be involved in raising up the ladder. Portable ladders must be prevented from slipping by securing the upper or lower end of their siderails using anti-skid media or other appropriate measures. Retractable and telescopic ladders must be used so that the individual parts are secured against mutual shifting.

Inspection of the ladder before use:

- 1) Checking the frame of the side rails for damage.
- 2) Checking the rungs and their attachment.
- 3) Checking the attachment of guide rails and checking these for potential deformation.
- 4) Checking the attachment of hooks and latches and checking these for potential deformation.
- 5) Checking the attachment of ladder joint reinforcements and checking these for potential deformation.
- 6) Checking the straps and bracing tubes.
- 7) Checking completeness and wear of the plastic end caps.
- 8) Checking of the ladder stabilizer and the plastic end caps.
- 9) Checking the overall rigidity of the frame of the ladder.

When setting up an extension ladder, it must first be spread on the ground to the required length and secured by safety latches.

After that we prop the base ladder up under the gradient of 70-75°. For long-term work or if work positioning is needed, we attempt to secure the ladder against fall as soon as possible. Only one person can use a portable ladder at a time. When moving on a ladder, the worker faces the ladder and must be in contact with the ladder with at least three limbs. The burdens up to 15 kg of weight can be carried up or down the ladder.

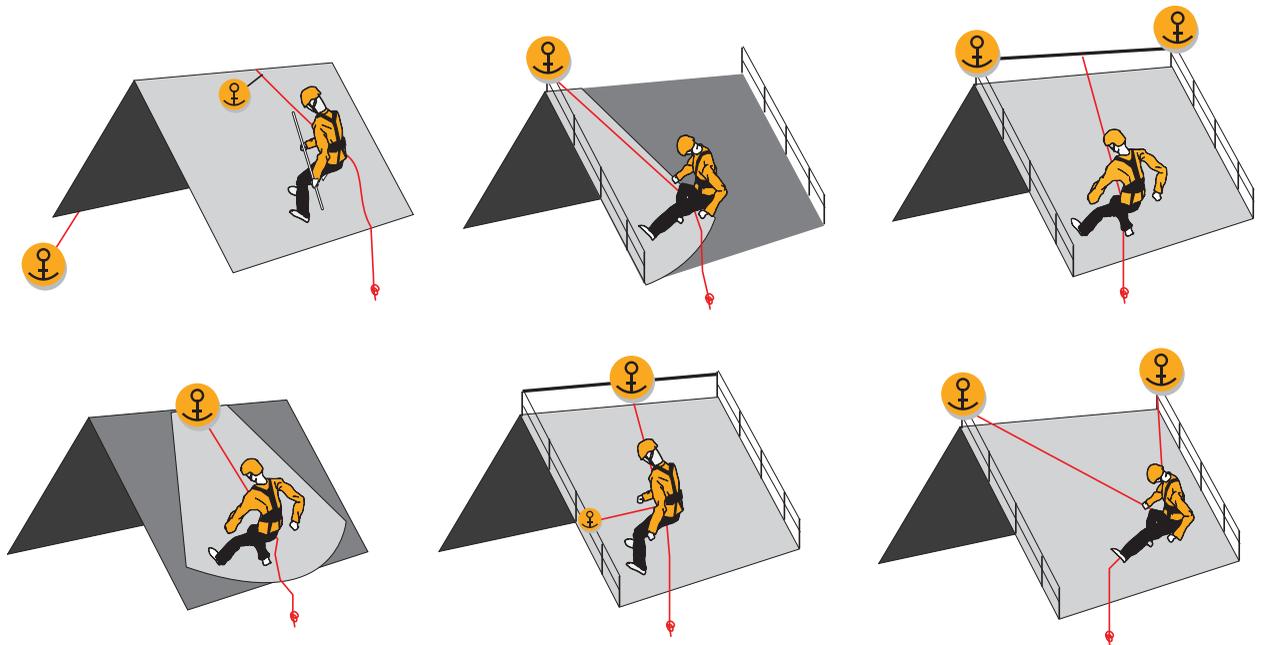
2.3.8 Work Positioning Systems



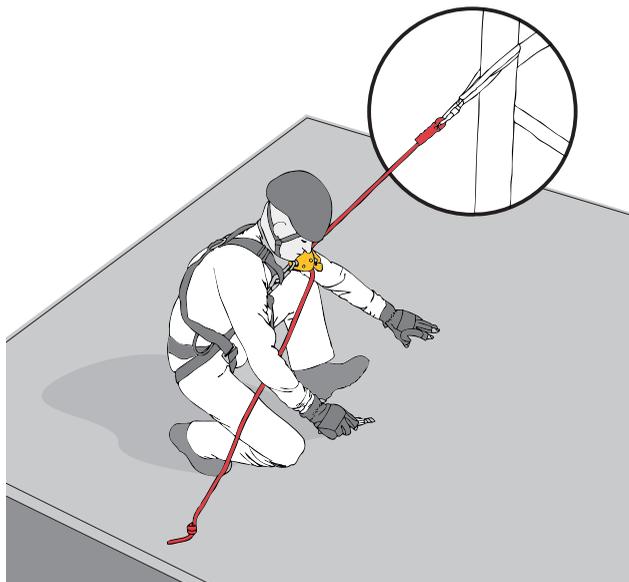
Keep in mind that the function of work positioning is not only to establish a stable working position but also to prevent any falls. Positioning side and central attachment points of the harness are used for positioning. It follows from the above stated that before starting to work a stable support must be created on the surfaces where it is missing, for example by using a work positioning harness.

The basic way of positioning is interconnecting of the side positioning loops of the harness around a sufficiently strong anchor point. Anchoring devices or positioning systems with adjustable length and rope adjustment devices may be used for work positioning.

Another way of positioning is hanging on the central point of the harness, for example hanging on the descender or on the rope length adjustment device.

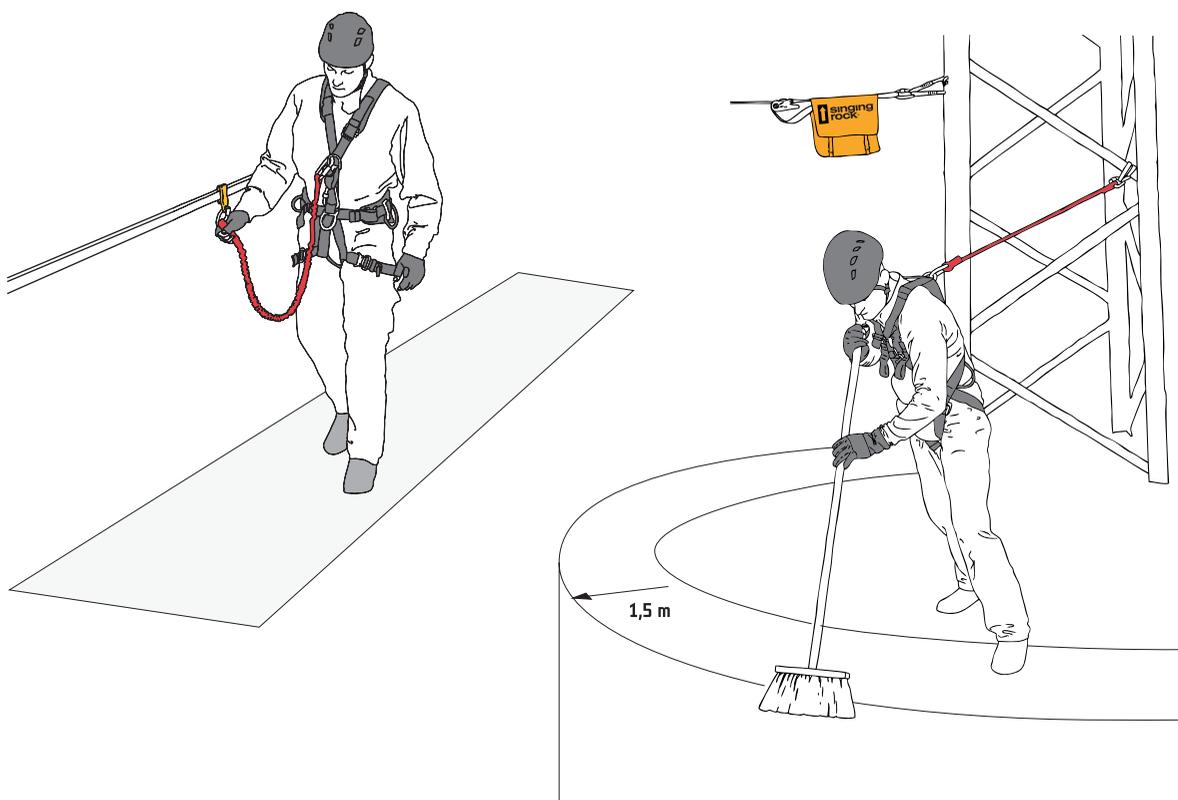


A special case of work positioning is the so-called work restraint, where the worker is attached with the harness and the connecting element to the anchor point so that the possibility of entering the area where the worker is in danger of fall is fully averted.



2.3.9 Securing at the Fall Edge

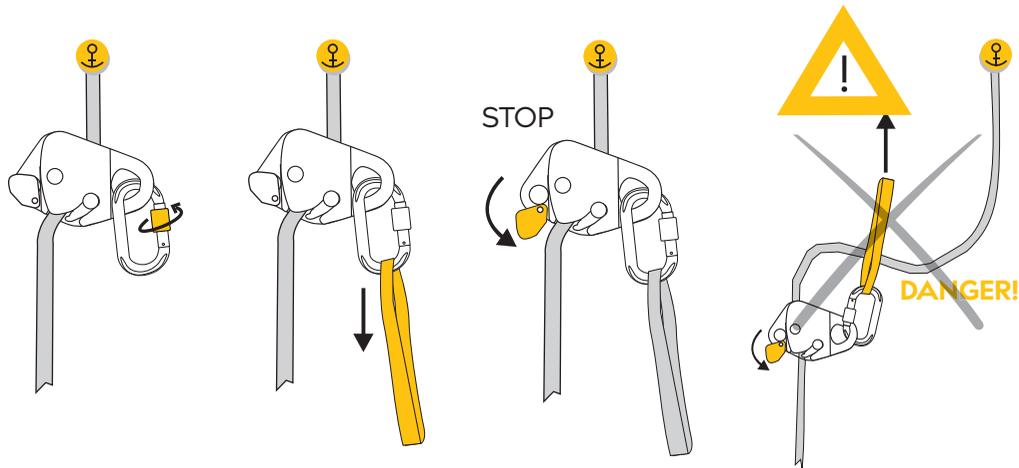
According to the Government Decree 362/2005 Coll., before entering the dangerous area the worker must be protected by work restraint system so that he does not get closer than 1.5m to the fall edge (A). If the worker can get closer than 1.5 m to the fall edge, he must be protected by fall arrest system. (B)



2.3.10 Fall Arresters

In cases where the work positioning systems cannot be used (for example if a safe movement at heights is needed) we use fall arresters. Fall arresters are always attached to the fall arrest attachment point of the harness. And the fall arresters should function with $FF < 1$. The fall arrest systems are tested for arresting the fall of one person, therefore the system can only be used by one person at a time.

Guided Type Fall Arresters

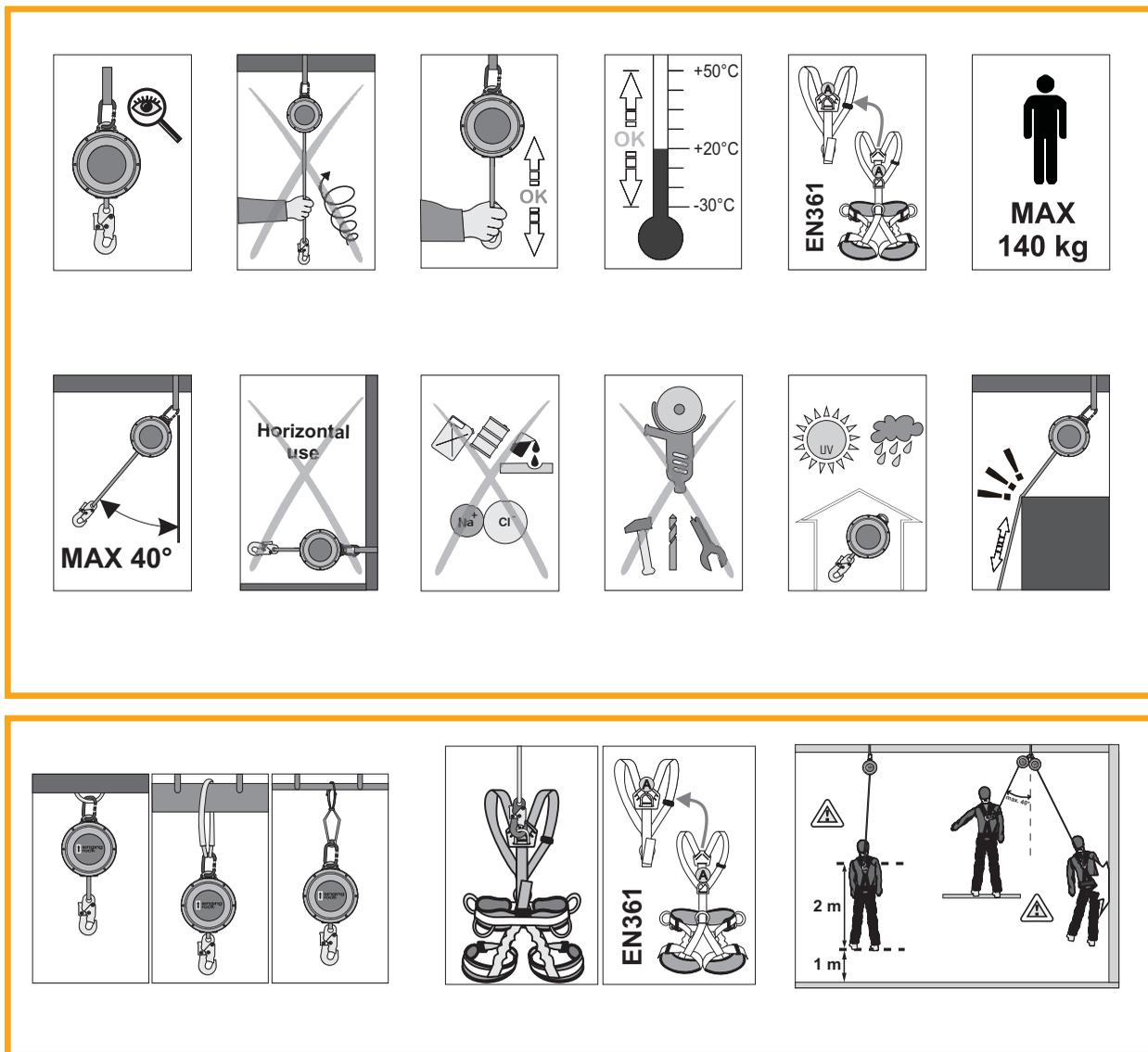


When installing the guided type fall arrester, we must take into account compatibility of the individual elements of the system (the type and diameter of the rope which can be used with the fall arrester is specified by the manufacturer. The manufacturer also specifies the possible alternatives of attaching the fall arrester to the harness – such as with a specific carabiner, sling or a fall absorber.) A slack of the rope is a frequent threat. This occurs above the fall arrester if the rope does not slide freely through the fall arrester. To prevent this, the loose end of the rope can be anchored or slightly loaded.

Retractable Fall Arresters



A retractable fall arrester has a similar function to the retractable safety belt in the car. Before its use it is recommended to perform a function check by slightly drawing the strap/cord and blocking it at the beginning, in the middle and at the end of its length and subsequent winding it up with control. When using a specific type of a fall arrester check whether its horizontal use (with fall factor of more than 0) is allowed.



2.3.11 Securing on Inclined Surfaces (Roofs etc.)

Inclined surfaces ended by a flat surface (i.e. without a possibility of falling over a fall edge)

We speak of an inclined surface if the gradient from the horizontal surface exceeds **25°**. If the gradient is lower, we do not have to adopt any additional measures.

With gradient of **25–45°** we protect the worker against slipping by using a fixed ladder or a single-line work positioning system, including a suitable work positioning harness.

With the gradient greater than **45°** the work positioning system must be supplemented by fall arrest system. Thus, we combine a fixed ladder with a suitable fall arrester (such as SR Inos, static rope with the Locker fall arrester). Or we set up a double rope technique with a working line and a safety line for arresting of a potential fall.

Inclined Surfaces Ended by a fall edge (i.e. with a Possibility of Fall of the Worker)

With gradient of less than **10°** we consider this surface a horizontal surface and have the following options of secure:

- e. Use of collective protection placed on the fall edge (such as guard railings EN 743305 and temporary edge protection systems EN13374).
- f. Preventing approaching an unsecured edge by a suitable obstacle with the minimum distance of 1.5 m from the fall edge.
- g. Work restraint (See Securing at the fall edge).
- h. Fall arrest system (See Securing at the fall edge)

For the gradient of **10° to 25°** the above-mentioned obstacle cannot be used, therefore we have the following options:

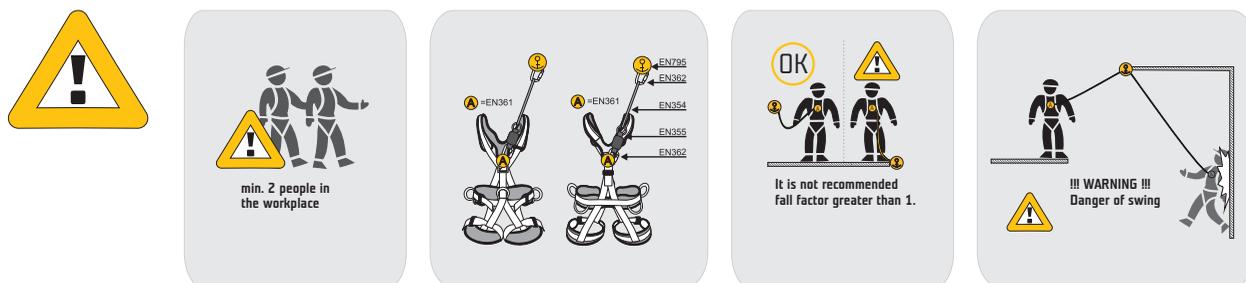
- a. Collective protection on the fall edge may be used as fall protection (for example the railings).
- b. Work restraint (See Securing at the fall edge).
- c. Fall arrest system (See Securing at the fall edge)

With gradients **from 25° to 45°** the worker must be protected not only against fall but also against slipping. The following options are available:

- a. Collective protection (in this case an EN 1263-1 safety net is more effective than guard rails, also the scaffolding fulfilling a function of collective protection can be used) combined with a fixed ladder protected against slipping.
- b. Collective protection (in this case a safety net is more suitable than guard rails, or a scaffolding fulfilling the function of collective protection may be used) combined with a single rope work positioning system.
- c. The fall arrest system (rope with Locker, SR INOS etc.) combined with a fixed ladder protected against slipping.
- d. Double rope technique consisting of the fall arrest system combined with work positioning rope.
- e. With the gradient higher than **45°** the work positioning system must be supplemented by fall arrest system. We thus combine a fixed ladder with a suitable fall arrester (such as SR Inos, static rope with the Locker fall arrester). Or we set up a double rope technique with a working line and a safety line for arresting of a potential fall.

2.3.12 Fall Absorbers

If the fall cannot be prevented the force acting on the human body should be reduced by using a fall absorber to reduce the effects of the impact force. The impact force increases with the length of the fall and the fall factor. If we make a graphical representation of an increase in impact force after a fall arrest over time, we can notice that the area of the shape (corresponding to the energy transferred to the anchor point or the person) remains the same, while the value of the maximum impact force and the time of effect of the impact force change. Thus, it can be deduced that the deformation of the fall absorber divides the maximum value of the impact force over time.



Calculating the Safe Height for the Use of a Fall Absorber

To calculate the Minimal Safety Distance - MSD the following values have to be added up.

A – length of the set [m]

B - lengthening of the set after the breaking action [m]

C – distance from the attachment point of the harness to the ground (depends on the body height) [m]

1 – 1m safety constant

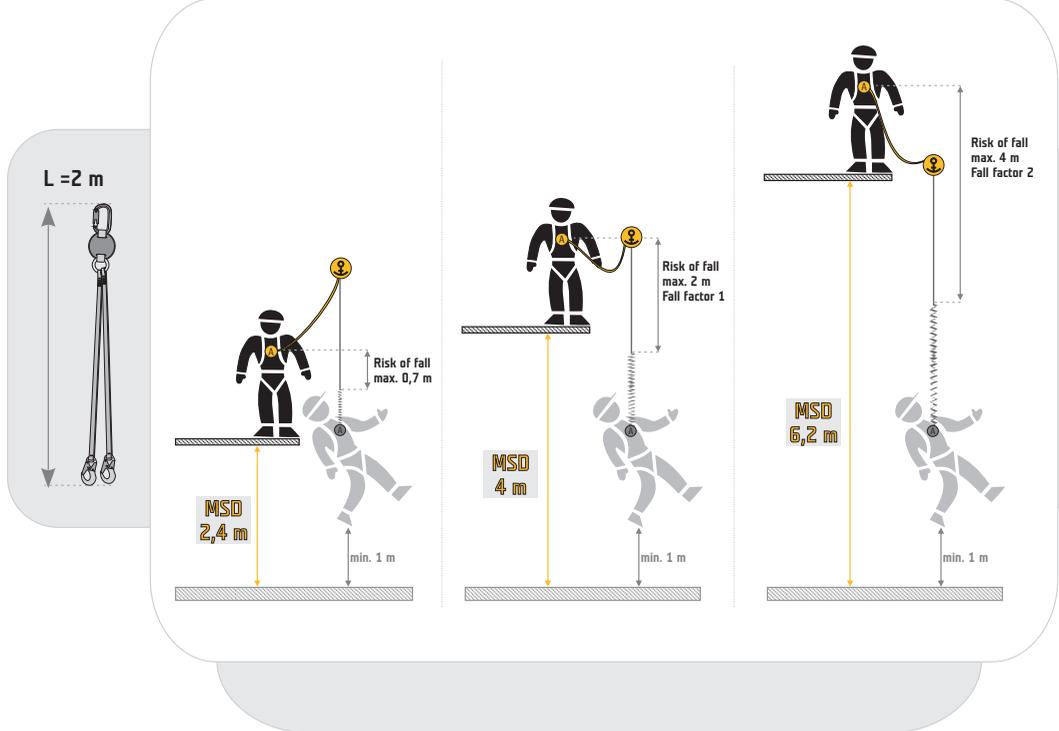
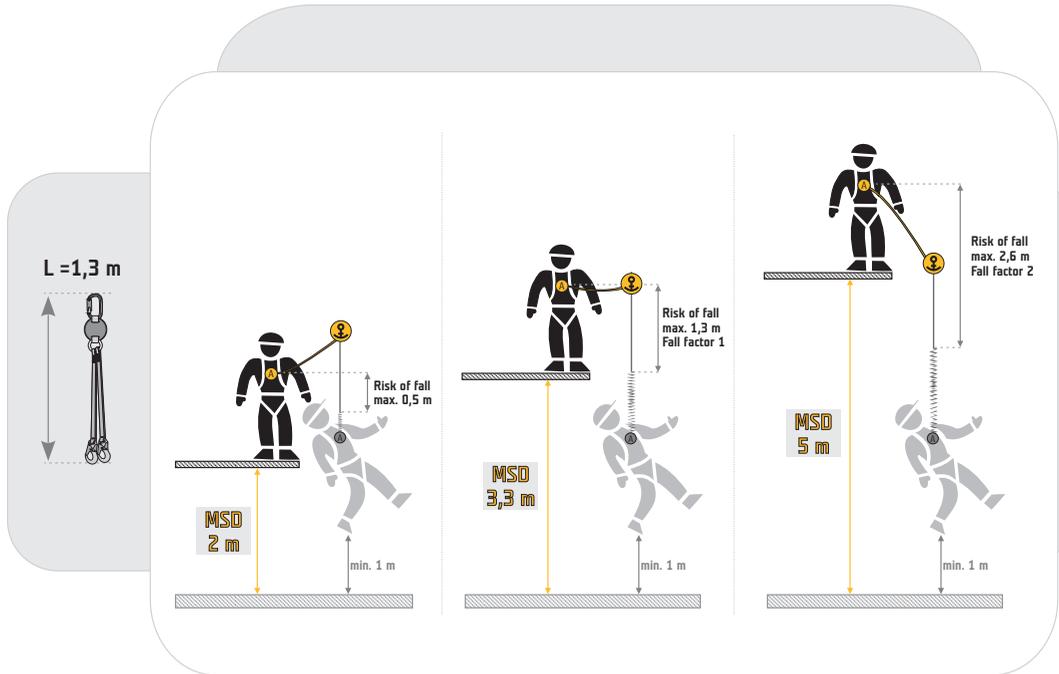
The minimal safe height is the sum of **MSD = A+B+C+1**

If the height of the anchor points with regard to MSD and FF is not sufficient, the length of the system can be reduced by bypassing the inactive length of the fall absorber by a carabiner.

The length of the potential fall must not under no circumstances exceed twice the length of the set (A) the fall absorber is designed for.

When climbing up or down with the fall absorber, we place the hooks so that the fall factor is as low as possible and we only manipulate with the hooks when we have sufficient support. In the space with a risk of fall the worker must be continuously secured. We mind the correct placement of the hooks so that its fracture does not occur (max. deviation from the vertical: 20°).

Before using the fall absorber, the worker checks, according to the Instructions for use, that the fall absorber has not been activated.



Evacuation and Rescue

Act No. 262/2006 Coll. imposes an obligation on the employer to ensure the evacuation of employees from the workplace. Evacuation procedure is described in the evacuation plan and must be prepared prior to commencement of the work.

For the system of rescue of the persons we prefer organizational measures that allow for easy lifting or lowering of the worker (RIG TO RESCUE), rescue kits facilitating the rescue with technical equipment, and rescue with the assistance of a specially trained worker, see the T2 rescue course.

Rig to Rescue

The safety system of the worker is prepared in advance in a way that allows for easy lowering of the worker on a descender in the event of a fall of the worker in the system.

Main principles:

- Sufficient length of the rope. (According to the situation in the picture three times the working length of the rope must be available)
- The working part of the rope is secured by a stopper knot at the bottom end of the rope and an Alpine butterfly at the upper part, so that unintended slack of the rope caused by the weight of the descender does not occur.
- The descender must be blocked in accordance with the instructions for use and secured against slipping by a security knot.

Rescue Using the Rescue Device

The rescue device allows to lift rescued persons, disconnect them from the original system and then to lower them to the ground.



2.4 Testing of the Acquired Skills

Test:

The worker completes a theoretical written test – 18 questions in 20 minutes. Minimal passing score: 90%
In the practical part, the instructor gives the worker an independent assignment to verify the acquired skills, which shall combine several practical topics with regard to the future occupation of the worker.

For example:

The worker carries out an ascent on a structure using a fall absorber and sets up a safe working position using work positioning. Subsequently he anchors the rope in two anchor points (See Y-hang) and attaches himself to a guided type fall arrester. Then he descends using a guided type fall arrester.

2.5 Glossary of Terms:

Cow's tail – (sometimes also referred to as a positioning lanyard) is used for work positioning and is attached to the central point of the harness. Preferably, we use slings made of dynamic rope to reduce impact force in the event of falling into this sling.

Carabiner – according to the EN 12275 standard, connector according to the EN 362 standard.

Back up – fall arrester according to the EN 353 standard.

Working line – the rope carrying the weight of the climber. Used for positioning.

Safety line – the free rope used for arresting a potential fall.

2.6 Literature:

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