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How to choose the right rope in Safety & Rescue?

Many beginners in rope access and working at heights are faced with the question: Which rope is the right for me? The selection of ropes on the market is vast, and each has specific properties that make it suitable or unsuitable for certain activities. In this article, we aim to provide support in the decision-making process, because the "right" rope depends on many factors. Before going into the specific rope characteristics, let's have a look at some underlying points that should be considered.

Norms & Standards

Working at height is involving risk and therefore it is regulated by different norms and standards depending on the type of work and the region working in. These standards also define which ropes are allowed to be used to carry out the actions in rope-assisted work.

The most important standards in rope access you should be familiar with when it comes to ropes are:

- EN 1891 A/B– (PPE for the prevention of falls from a height – Low-stretch Kernmantle ropes) is the most important European standard in rope access and specifies requirements for low stretch kernmantle ropes used in working at height.

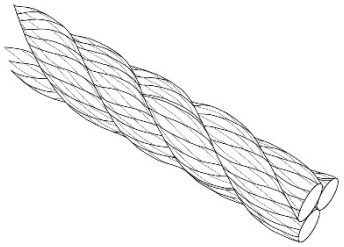
- NFPA 2500 (1983) - (Standards for Operations and Training for Technical Search and Rescue Incidents and Life Safety Rope and Equipment for Emergency Services) from the National Fire Protection Association is the most important standard in the US when it comes to emergency services and sets the standard for ropes used.

Additional standards that regulate that can be useful are, EN 892, EN 564, ANSI Z133 and many more. Please find more detailed information on all standards as well as the technical requirements on the ropes for each standard here in our brainBOX.

Rope types

Three-Strand Ropes

This is the most traditional form of rope that has already been used in ancient times. Three strands of fibers are each twisted tight and then again twisted together to form a rope. In comparison to the other two rope types explained below, the feature lower breaking strength and low abrasion resistance and have a tendency to rotate under load.

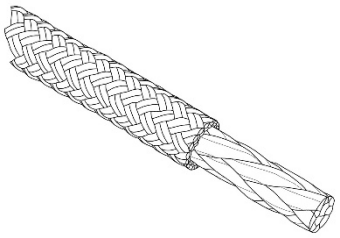


What are they used for?

In Europe these ropes are hardly used any more in a working at height situation. However, in the US or Asia, three strand ropes are still used as hauling ropes or as a lifeline involving a rope grab. In the Teufelberger portfolio, the only three

strand rope suitable for height activities are the Multiline II (no certification) and New England Multiline (certified to ACCT and CI-1805) which are used in challenge courses.

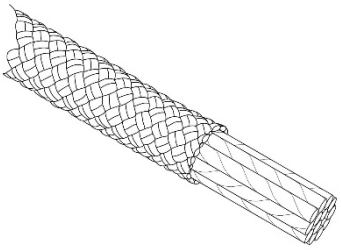
Double Braid Ropes



These ropes feature a braided core covered by a braided sheath. In these ropes, the load bearing function is shared quite equally between cover and core. They have very low elongation and remain round under load.

What are they used for?
Double braid ropes are mainly used as a load rope in working at height as they show very little rotation and are soft in grip.

Kernmantle Ropes



In these ropes, a various number of loosely twisted strands form the core (Kern) which is surrounded by a tightly braided cover of 32, 40 or 48 strands (Mantle). The core bears about 70 % of the load while the cover keeps the rope round but yet flexible and protects the cores from abrasion. Depending on the material and the production process, these ropes can have very different characteristics. That's why Kernmantle ropes are divided into two main types:

Dynamic ropes
These ropes certified to EN 892 are used in recreational climbing. They offer high elongation (approx. 30%) and therefore are able to absorb the high shock forces occurring when falling in the rope.

What are they used for?
Dynamic ropes are used in recreational and sports climbing either outside or in the climbing gym. In a rope access setting, they can also be used as positioning lanyards/cowtails.

Static ropes (Semi-static)
These ropes offer low elongation (no more than 5%) and high breaking force, they stay round in descend devices, are good to grip and do not rotate. Static ropes are certified to EN 1891 and/or NFPA 2500 (1983) and are designed to belay people in rope assisted work.

What are they used for?
Static ropes are the right ropes to be chosen in industrial climbing and rope access. They are designed and certified to be used as working line or backup line and are suited for all types of work positioning, restraint, rescue or also caving task.

HOW TO CHOOSE THE RIGHT ROPE?

Here is an overview of the different rope types explained before and their intended use in working at height.

3-Strand Rope	Double Braid Rope	Kernmantle Rope Static	Kernmantle Rope Dynamic

• Hauling Line
• Life line (in safety systems or challenge courses)
	• Load line in winches
	• Climbing line in treecare
		• Working line and/or Back-up line in
		  ○ Rope Access
		  ○ Industrial Climbing
		  ○ Rope Rescue
			• Climbing rope in recreational or sport climbing
			• Cowtails / Lanyards in rope access

Rope material

Typically, Kernmantle ropes for working at height are made of a Polyamide core due to its elongation features and a Polyamide or Polyester cover. However, there are also other materials that can be used and give the ropes different characteristics. Aramids adds cut, abrasion and heat resistance ; UHMWPE fibers are high strength and low stretch and Polypropylene makes ropes float. In our brainBOX you find more detailed information about the different materials and their features.

Our recommendations

As for industrial climbing, rope access and rope rescue, static Kernmantle ropes are predominantly used as working line, back-up line or horizontal line, we will focus on this rope type in this section. There is a big choice of ropes available on the market, so let’s have a look which ropes fits best for your purpose and which Teufelberger rope will be the best to fulfill the task.

Daily business

In your day-to-day business you want an all-round EN1891A rope that works for as many tasks as possible. It should be good to handle and work well in devices. Average elongation and breaking strength will do for the job. No special material is needed for core or cover. If your rope gets dirty or worn quickly due to the task, you will probably prefer a rope with a good price point.

HOW TO CHOOSE THE RIGHT ROPE?

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Our recommendations:

- Patron 10,5 mm or 11mm (EN 1891A)
- KM Pro 11mm (EN 1891A)

Great height & Rope Rescue

When regularly working at great heights (e.g. windmills) or with the need to move two people loads (e.g. rescue) you want a rope that comes with very low elongation and very high breaking strength. The lighter the rope the easier it is to work with the long rope. The suitable ropes will mostly have a Polyester cover as this reduces elongation in the rope. But it also helps to keep the rope dry and protected from seawater and UV.

Our recommendations:

- KM G 11mm (NFPA)
- KM III 11mm (NFPA, EN 1891A)
- KM Pro 11mm (NFPA, EN 1891A)

Abrasive & rough environment

If your rope needs to handle abrasive and rough environment, you want a rope that has a very robust cover. This can either be provided by thicker cover yarns or the integration of Aramid fibers in the cover or intermediate cover that protects the core. You might also use a thicker diameter in order to have a greater safety margin.

Our recommendations:

- KM III 11mm or 13 mm (NFPA, EN 1891A)
- KM III Max 11mm or 13mm (EN 1891A, NFPA)
- KM Pro 11mm (EN 1891A)
- Rescue Assault 11mm (EN 1891A)
- Vulcanus 10,5 mm (EN 1891A)

Hot environment

If you are working in hot environments or your rope might get in touch with hot structures you need to be very careful. A rope with an Aramid cover adds additional safety and protects the core against heat. However, a proper risk analysis is critical to avoid safety issues.

Our recommendation:

- Vulcanus 10,5 mm (EN 1891A)

Wet environment & UV exposure

Polyester is better in wet environments as it does absorb water or shrink, therefore a Polyester cover protects the Nylon core from getting wet and stiffer. Polyester also offers better resistance against UV light, seawater or chemicals than Polyamide.

Our recommendations:

- KM III (NFPA, EN 1891A)
- KM Pro (EN 1891A)
- KM G (NFPA)

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Work with automatic ascenders

There are ropes that are designed for good compatibility with automatic ascender devices or rescue devices. Those ropes have a very compact core that does not deform during use. Their tightly braided cover reduces sheath slippage.

Our recommendation:

- Patron Plus 11mm

Tactical operations

Operations organizations like the police or army have special requirements to ropes. Small diameter, light weight or cut resistance can be needed. Certifications often are neglected; it is more important that the rope fits the task.

Our recommendations:

- Rescue Assault 11mm (EN 1891A)
- Aramid Escape 7.5 mm
- Resc Tech 8 mm
- T-12
- Tech Line

Treecare

Teufelberger offers a wide range of climbing ropes for Treecare. From the classic Braided Safety Blue with a 16-strand cover that works well with friction hitches to the modern drenaLINE with a that offers a light and compact construction with a 32-strand cover allowing smooth ascents and descents in SRT (singer rope technique) and DRT (double rope technique). For more information on that please check our section on “How to choose the right rope in Treecare”.

Please always consider

- Always check your rope before and after use
- If your rope is dirty, wash it according to the instructions in the manual
- Store your ropes in dry conditions and protected from heat and sunlight
- Always choose the right rope diameter for your devices
- Your rigging is only as strong as the weakest part, most of the time this is not the rope but any knot or hardware
- Keep in mind that knots reduce breaking strength of a rope by up to 50% depending on the type of knot used. Knots can also cause irreversible deformation like crimping and twisting to the rope