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UIAA
SAFETY

UIAA STANDARD 101 / ROPES

Recommendations for Inspection and Retirement

Foreword

The UIAA equipment standard provides a baseline for equipment performance in a test lab under controlled conditions on new equipment. Although these test conditions are relevant to the conditions encountered climbing, conditions encountered at the crags and the condition of the equipment are equally important. This recommendation from the UIAA member federation The British Mountaineering Council (BMC) provides vital equipment information that is NOT explicitly addressed in the standard, particularly failure modes of the equipment and recommendations for the use, inspection, maintenance, and retirement of equipment.

These recommendations are of necessity general. For any specific piece of equipment, the primary source for all equipment information is the manufacturer. Always read and heed the manufacturer's warnings and instructions for use, inspection, maintenance, and retirement of equipment. Taken together, the UIAA standard, the BMC recommendations, and the manufacturer's instructions provide a sound basis for understanding climbing equipment and its limitations. This understanding, in conjunction with best practices, is the basis for managing the risk associated with climbing and the use of climbing equipment.

THE FOLLOWING INFORMATION ON USE, CARE AND MAINTENANCE COMES FROM THE BMC BOOKLET: ***CARE and MAINTENANCE***

Cf. http://www.thebmc.co.uk/Feature.aspx?id=1170

ROPES

by Dave Brook

The following section provides a summary of a very important area of equipment. See the BMC ***Ropes*** *booklet for more comprehensive coverage.*

Introduction

The rope is the most vital piece of safety equipment for use in climbing and mountaineering, and was one of the first pieces of gear to be employed for safety in the sport. The earliest ropes used by the pioneers were made from natural fibres like manila or hemp, but their low energy-absorption capability and breaking strain meant that they offered more in the way of psychological rather than actual protection, very often breaking whilst in use!

The ropes were constructed by twisting three thick bundles of fibres together to form a cord of around 11mm thickness – a *hawser-laid rope*. Immediately after WWII, improvements made in materials during the conflict allowed rope manufacturers to start using nylon cords, which provided much greater energy absorption, although ropes were still hawser-laid in construction.

"Roped together on the tricky descent, the hopelessly inexperienced Hadow slipped, pulling with him three of the others. The last in line, who were tied to the rest of the chain by a weak sash-cord which broke under the strain, could only gape aghast as one of the most famous guides in the Alps, an English Lord, an accomplished English climber and an unfortunate novice, plummeted to their deaths."

"The description of Whymper's disastrous first ascent of the Matterhorn, taken from *A Brief History of British Mountaineering*

Photos: *BMC Collection Doré's etching of Whymper's disaster on the Matterhorn in 1865*

These ropes were a vast improvement over the old fibres, allowing a fall to be stopped reliably without the rope breaking. The first modern climbing ropes were made in the early 50s in a *kernmantle construction* – a braided sheath (the *mantle*) surrounding a load-bearing inner core (the *kern*). All ropes manufactured today are of this design, which offers vastly superior handling, durability and energy absorption. However, ropes are manufactured to many different specifications for different uses, and an outline of the varieties available is given below (refer to the BMC Ropes booklet for a more in depth discussion):

Dynamic Ropes

· **Single (full) ropes –** Classically 11mm in diameter, but now varying from 9.0mm upwards, these ropes are used singly in situations where a leader fall is a possibility.

· **Half ropes –** Historically 9mm in diameter (now from 8.1mm), two half ropes are used simultaneously to protect against leader falls, and have the advantage of allowing more spaced protection to be placed without prohibitive rope drag. Having two ropes as opposed to one also allows climbers to abseil twice as far in one go.

· **Twin ropes –** These are of a smaller diameter than half ropes, and must be used in pairs with both ropes clipped into every piece of protection. Very rare in the UK, but common in the Alps, and where you want to use the same rope for climbing and abseiling (after climbing many pitches you have to abseil down using the same belay).

Low-Stretch Ropes

Primarily used by climbers (and cavers) for abseiling or ascending, these ropes have very low stretch and have little energy absorbing capability and so ***must not be used for lead climbing!***

Accessory Cord

Smaller diameter rope, used for slings, Prusik loops, etc. It should be noted that accessory cord is not designed to have any energy absorption capability, and must never be used as climbing rope. See *Chapter 3 – Slings* for further information on standards, care and maintenance.

Relevant standards

Ropes of kernmantle construction for use in climbing and mountaineering (and that are designed to hold leader falls) are manufactured to standard EN 892. Low stretch ropes designed for uses other than holding leader falls (eg. abseiling or

ascending) are made to EN 1891. The use of these ropes and their sub-types is fully covered in the BMC booklet on ropes, to which reference should be made.

Observed faults and failures

The Technical Committee *(*1 UIAA comment, see end of paragraph)* has received 20 reports of failures and/or serious damage to ropes (both dynamic and static) over the last 15 years. Two failures were caused by contamination of the rope by corrosive substances, one (dynamic) rope was damaged – but did not fail – as a result of excessive jumaring *(*2 UIAA comment, see end of paragraph)* and the remainder were due to serious abrasion over rough or sharp rock edges. In a small number of cases, abrasion to the rope resulted in its failure during a fall with serious consequences, including one fatality.

UIAA Comments on this part

1) The BMC Technical Committee

2) use of a rope clamp

How to prevent failure in use

The key to preventing failure during use is to minimise abrasion, or at least recognise serious abrasion to a rope before you use it through *regular physical inspection of the entire length of the rope*. This is probably most easily done whilst coiling the rope after a climbing session, and should be practised without fail. Assuming that there is no visible damage to the rope when you begin using it, the overriding priority whilst in use is to *avoid allowing the rope to drag over sharp edges and rough rock* as in Figure 10.3. This necessitates constant attention to where the rope might run during a climb, and also to how and where it will be loaded over the rock in the event of a fall. This in turn requires some skill and knowledge on the part of the climbers whilst placing runners (look out for sharp edges and protrusions near your runner placements) and setting up top-rope or belay anchors (often the use of a rope protector or padding material is appropriate).

Figure 10.3 Serious damage to a rope in use ***Photo:*** *BMC Collection*

In addition:

· Do not throw the rope down onto gritty or sandy ground if at all possible – small particles of dirt or grit can adhere to the nylon and then be ground into the sheath or core during normal use. Potentially this could cut some of the ropes fibres and cause it to fail with no visible evidence that it had been weakened.

· Avoid standing on your rope for the very same reason. It goes without saying that you should exercise extreme caution whilst using your rope with ice tools and crampons.

· It is advisable to avoid speedy abseils, which allow the abseil device to heat up very rapidly and can cause melting of the rope if the descender remains in contact with it at the end of the abseil – nylon has a low melting point!

Routine care and maintenance

The most important aspect of caring for your rope has already been mentioned above, but it is so vital that it is worth saying again:

Inspect the rope frequently (ideally before and after every use) for signs of abrasion, damage and wear and tear.

Most ropes are not user-maintainable, and the only task you should need to perform during its life is that of cleaning it. To do this use warm water and a very

mild (pH neutral) detergent such as natural soap flakes (if any at all) or a proprietary cleaning product from one of the manufacturers. A rope can be cleaned and soaked in the bath, or pulled through a plastic tube with soft brushes on the inside, several versions of which are commercially available. Always follow cleaning with copious rinsing in fresh, clean water and never use a pressure washer as this can drive any grit or dirt deeper into the rope, where it may damage the nylon fibres and cause the rope to fail.

Ropes are best stored (long term) in a cool dark, dry place. Be especially careful to avoid contact with corrosive substances in places such as garages. It is sensible to avoid strong light and extended exposure to UV rays, although there are no known instances of a rope failing due to UV degradation, since the core is protected from UV by the sheath.

Degradation and discard criteria

The following is adapted from the BMC ropes booklet

The BMC receives literally hundreds of calls each year asking for advice on this subject. Ideally, it could be said that, after a given time or pattern of use, a rope should be retired, but in reality there are too many variables for such a simplistic answer to be given. The responsibility lies with the owner of the rope to make a judgement, based on his/her unique knowledge of how the rope has been used through its lifetime and of the factors that will degrade a rope.

To further confuse the situation, manufacturers are now required to give advice on when to retire ropes with their product user information supplied with each rope. This puts them in a difficult position and understandably, they will tend to play safe and give conservative figures for a ropes lifetime. This is usually quoted as 3 to 5 years, regardless of pattern of use. Such figures are not particularly helpful when deciding to retire a rope as an unlucky rockfall or severe abrasion can ruin a rope on its first outing, whilst another rope may have sustained no damage or leader falls over five years of light use (and may well be suitable for another five!).

Knowledge of a ropes history is vital when making decisions about when to retire or downgrade it, since every traumatic event suffered by the rope will cause some damage. As a general rule, you should consider downgrading any rope that has sustained a serious fall (fall factor greater than 1). Apart from knowing the number and severity of falls that a rope has sustained, a more general knowledge of its type and conditions of use is also important. You can check for localised internal damage or twisting by running it slowly through your fingers and feeling for any irregularities or unevenness – the existence of either could indicate serious internal damage. Unfortunately, the absence of either does not mean that a rope is not damaged – as mentioned above small particles of grit can work their way inside a rope and damage the core invisibly.

Figure 10.4 Furry, over-used ropes ***Photo:*** *BMC Collection*

The general feel of a rope also gives a good indication as to its condition. For instance, a rope that was once soft, smooth and supple and has become stiff, furry and liable to kinking should perhaps be downgraded, as these characteristics indicate the onset of permanent damage.

As a very general figure then, with regular (every weekend and midweek) usage and no major incidents, you should not expect to get more than around three years out of a rope before downgrading it or retiring it outright. Heavy use (ie. most days) will greatly reduce this lifetime, and it is quite possible to wear out a rope in less than six months, whilst on a long holiday, for example. Obviously, if used less and well cared for, a rope will have a much longer lifetime.

There is some evidence to suggest that if a rope is 'broken in' gently – by alternating the lead end and avoiding hard loading – it will have a longer life than a rope that is used hard from new. However, the reasons for this are not fully understood.

Downgrading a rope – several times above, it has been suggested that certain criteria mean that you should downgrade your rope. Essentially, this means that a rope need not be considered unusable at the end of its life as a lead rope, but can still be used for top-roping, abseiling or as a glacier rope.

To summarise:

The decision on when to retire your rope is your own responsibility. The best you can do is base your decision on knowledge of how a rope has been used, and how it feels and looks. Keeping a log of its use, and regularly checking for damage is good practice, and if in doubt you can ask the advice of other experienced climbers.

Remember: If you think it may be time to replace an item of equipment – it probably is!