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## CMC RESCUE TECHNICAL REPORTS



# ROPE LIFE

## WHEN TO RETIRE YOUR LIFE SAFETY ROPE

Section 5.2.2 of ASTM F1740-96 (2007) *Guide for Inspection of Nylon, Polyester, or Nylon/Polyester Blend, or Both Kernmantle Rope* recommends 10 years as a maximum rope life. The committee felt that after 10 years of storage, it might be worth considering replacement of a life safety rope even though the rope had not been used.

We had the opportunity to test rope stored for seven years by a Bridger Coal's (WY) mine rescue team. The rope had been stored on the spool in a cool, dry location for seven years. The samples were 12.5-mm (1/2-in) diameter, low-stretch kernmantle rope. The manufacturer's new rope tensile strength rating was 40.3 kN (9,059 lbf). For comparison, the independent lab tests on new rope averaged 47.0 kN (10,566 lbf). The test results from the Bridger Coal samples suggest minimal strength loss when the rope is properly stored.

Break #1	50.2 kN (11,285 lbf)
Break #2	47.5 kN (10,678 lbf)
Break #3	49.3 kN (11,083 lbf)
Average	49.0 kN (11,015 lbf)

What happens when we actually take a life safety rope out into the field and use it in the dirt, sun, rain, running it through pulleys, ratchets and descenders? Rope is a textile product and abrasion on the fibers through bending the rope, tying knots, running it over rough surfaces and loading/unloading cycles cause wear that decreases the strength of the rope. The unknown factor is how quickly this micro-level damage adds up to a significant decrease in the working strength of the rope.

The National City (CA) Fire Department sent us a rope they described as old and well used. They said it was the worst looking of the ropes they had in service and its acquisition preceded any recordkeeping. The marker tape indicated the rope was BlueWater II manufactured in 1983. BlueWater's catalog specifies a 34.1 kN (7,666 lbf) tensile strength for 12.5-mm (1/2-in) diameter BlueWater II. Tested by Wellington Commercial Cordage, the results showed an approximate 15% strength loss after nearly 10 years.

**TESTED. PROVEN. TRUSTED.**

Break #1	28.7 kN (6,452 lbf)
Break #2	30.5 kN (6,856 lbf)
Average	29.6 kN (6,654 lbf)

Bruce Smith, co-author of *On Rope*, collected and broke more than 100 samples of used caving rope. Using the rope's history, each sample was categorized as like new, used or abused. Like-new ropes averaged a strength loss of 1.5% to 2% per year and used ropes 3% to 4% per year. Smith observed that "care of the rope has a far greater impact on a rope's life than age."<sup>1</sup>

At this time, the evidence suggests that with average use a rescue rope will lose 1.5% to 2% of its strength per year. Under hard use, a rope can lose 3% to 5% per year. While that information will allow you to calculate how much strength loss has occurred, it doesn't really tell you whether to retire the rope. You know how much strength you are losing, but you must then decide how much strength loss is acceptable before retiring the rope. As of today, there are no standards or suggested minimums for how strong a *used* life safety rope should be.

Aside from shelf life and strength loss, the other reason for retirement is damage or suspected damage. The inspection may find evidence of damage, or a team member may report that the rope suffered an impact load, was hit by a rock or smashed between the litter and the wall. If you do decide to retire the rope, take it apart and look inside at the damaged area to get a better understanding of how much abuse the sheath can take and still protect the core. More often than not, no damage to the core can be seen.

***Again, if you have any doubt about the integrity of your life safety rope, retire it. No equipment replacement cost is worth putting a rescuer's life at risk.***

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<sup>1</sup> Smith, Bruce. "Aging Rope." *Nylon Highway*. Issue No. 25. Huntsville, AL: Vertical Section, National Speleological Society; January, 1988.