



CMC Rescue Technical Report # 1

ROPE LIFE: When to Retire Your Life Safety Rope

“When should I retire a life safety rope” is a very commonly asked question. This was particularly true a decade ago when the issue was not addressed by any of the rescue standards and we decided to look into it. We started by asking the nylon manufacturer, DuPont, and were told that the shelf life of their Nylon T707 should be indefinite unless altered by excessive exposure to certain chemicals, heat and sunlight.

Checking with the safety industry that uses rope for fall protection, the recommendation of one author was 1 to 2 years of use and 5 years of storage for synthetic ropes.¹ As of 2006, the draft of the revision of the fall protection standard, ANSI Z359, does not address shelf life or useful life of fall protection ropes.

The Climbing Sports Group of the Outdoor Recreation Coalition of America makes the following recommendation for retiring a climbing rope.

When in doubt, retire your rope. Generally, ropes should be discarded after holding a long, hard fall; if they have flat or soft spots; become stiff; or show sheath damage.

Retire climbing ropes after no more than four years of occasional use, two years of weekend climbing, or one year of active use. Retiring a rope after only six months of hard use isn't uncommon; some of the climbing gyms are finding that sheaths are wearing out after only a few weeks of intensive use. Also, multiple short lead falls, bounding rappels, and shock-loaded top-rope falls can have a negative accumulative effect of the rope's shock-absorbing capacity.

How does this apply to ropes used for rescue? While used less often than ropes used for fall protection, rescue ropes probably see more abuse. They are dragged over rocks, building edges, and roadside debris. Since a rescue rope probably sees fewer impact loads than a sport climbing rope and most have a much heavier sheath, would a rescue rope have a longer rope life?

In June of 1990, we sent samples of Rhino Rescue Rope to Wellington Commercial Cordage² for testing. The rope had been stored on the spool in a cool, dry location for seven years by Bridger Coal's mine rescue team in Wyoming

The sample was 1/2-inch (12.7 mm) diameter, low-stretch kernmantle rope. The manufacturer's new rope tensile strength rating was 9,000 pounds (40.34 kN). For comparison, the independent lab tests on new Rhino Rescue Rope in 1983 averaged 10,495 pounds (47.04 kN). The test results from the Bridger Coal samples suggest minimal strength loss when the rope is properly stored.

Break #1	11,200 pounds (50.20 kN)
Break #2	10,600 pounds (47.51 kN)
Break #3	11,000 pounds (49.30 kN)
Average	10,933 pounds (49.00 kN)

In June of 1992, 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 record keeping. The marker tape indicated the rope was BlueWater II manufactured in 1983. BlueWater's catalog specifies a 7,600 pound (34.06 kN) tensile strength for 1/2 inch (12.7 mm) diameter BlueWater II. Tested by Wellington Commercial Cordage, the results showed an approximate 15% strength loss after nearly 10 years.

Break #1	6,400 pounds (28.69 kN)
Break #2	6,800 pounds (30.48 kN)
Average	6,600 pounds (29.58 kN)

Bruce Smith, co-author of *On Rope*, collected and broke over 100 samples of used caving rope. Using each 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 percent per year, and used ropes 3 to 4 percent per year. Smith observed that "care of the rope has a far greater impact on a rope's life than age."³

At this time the evidence suggests that with average use a rescue rope will lose 1.5 to 2 percent of its strength per year. Under hard use, a rope can lose 3 to 5 percent per year. While that information will allow you to calculate how much strength loss has occurred, it does not really tell you whether to retire the rope. You know how much strength you are losing, but you then must 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.

Section 5.2.2 of ASTM F 1740 - 96 *Guide for Inspection of Nylon, Polyester, or Nylon/Polyester Blend, or Both Kernmantle Rope*, recommends ten years as a maximum rope life. The committee felt that after 10 years of storage, it might be worth considering replacement a life support rope that has not seen use. As noted above, how a rope is used and stored has a greater effect on rope life than any other factor.

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 stretcher 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 lifeline, retire it. Rope is just not expensive enough to risk a rescuer's life over.

© November 1998, October 2006 CMC Rescue, Inc.

¹ Ellis, J. Nigel. *Introduction to Fall Safety*. Des Plaines, IL: American Society of Safety Engineers; 1998.

² Wellington Commercial Cordage no longer manufactures life safety rope.

³ Smith, Bruce. "Aging Rope." *Nylon Highway*. Issue No. 25. Huntsville, AL: Vertical Section, National Speleological Society; January, 1988.