Rope Care and Maintenance

Ropes require very little maintenance, but they can be damaged through improper care. It is extremely important that all firefighters understand a few basic principles in rope handling and maintenance. Rope lasts much longer with proper care.

Avoid jumping, walking, sitting, standing, or dropping objects on a rope. This type of mistreatment could damage the fibers of the rope. Although at times not practical, ropes should contact the ground as little as possible. Contact with dirt by laying the rope on the ground or by dragging it allows small dirt particles to become imbedded in the sheath. These particles can work through to the core and slowly cut the rope fibers. Edge protection and chaffing material minimize this damage. Ropes should not extend outside the bag when stored.

Avoid sharp or rough edges and sharp bends, especially when the rope must be moved back and forth, as these can cut rope fibers. Place edge rollers or padding between the rope and any unavoidable sharp edges. Use edge protection any time there is contact between the rope and an abrasive surface.

Never allow chemicals to come in contact with rope. Chemical exposure may weaken or damage the nylon without visible evidence. Avoid products that contain benzene, phenol (pine oil cleaners), carbon tetrachloride, formaldehyde, and petroleum products (gasoline). DO NOT use permanent marking pens as these products contain benzene. Softwear ends can be marked with a “Rub-A-Dub” laundry-marking pen. Always consult the manufacturer instructions for marking of equipment.

Avoid exposing rope to sunlight for long periods (especially when storing). Ultraviolet radiation will significantly shorten the life of the nylon rope.

Nylon fiber is affected by the absorption of water. Nylon is hydrophilic meaning it will absorb water. The overall strength and stretch can be greatly affected by moisture in the fiber. Sterling Rope’s in-house testing shows that loss of strength in wet nylon ropes may be as high as 70%. A wet rope is weaker, and up to 40% heavier, than a normal one. A wet rope is harder to handle and may not fit in a pulley or other hardware. Try to use polyester or polypropylene ropes in excessively wet or water rescue situations.

High temperatures will damage nylon very quickly. The minimum melting temperature is 400° F. A common problem occurs when a rope runs through a brake or rappel system too rapidly. Nylon should also never be moved across another piece of nylon, as the heat generated would melt the stationary piece in a short period. Always use a carabineer between two pieces of software. In normal circumstances a rope runs through a brake slowly and the brake is “set” when the rope is not moving at all. A rescue rope should not be allowed to run rapidly through prusiks used as a brake. This will generate a tremendous amount of heat in a very short period of time and will melt the stationary piece of equipment.
Rope Inspection

NFPA 1500 requires all ropes to be inspected after each use. A record of this inspection and any pertinent findings should be recorded on the rope log. Inspection often reveals that the rope needs to be cleaned to remove dirt or mud. There are several important conditions and flaws to look for when inspecting rope:

Visually inspect the rope for the following:

— Dirt or other foreign debris imbedded in the rope fibers

— Cuts, abrasions, unusual wear, and other damage to the sheath. Fuzz appears on the surface of the rope; as individual fibers are broken. Closer examination of the fibers with a magnifying glass is required if this type of sheath damage appears. By examining the base of each strand one can estimate the ratio of cut to uncut fibers. When 50% of the fibers are broken in one pique* or when 30% of the fibers are broken over a larger area, the rope should be taken out of service.

— Discoloration of the rope that could be from chemical contamination

— Burn marks from excessive heat

— Rust from improper storage

*A “pike” is the area of a braided sheath where two strands of the rope intersect. This is where one strand passes over another. This area forms a visible square on the sheath. A pique refers to one of these strands only.

Feel the rope for the following

— Dirt or other foreign debris imbedded in the rope fibers

— Inconsistencies in the diameter of the rope

— Soft spots, bulges and kinks

— Inconsistencies in the flexibility and texture

— Hard, melted or glazed areas on the sheath

— Wetness, nylon loses approximately 15 percent of its strength when wet.

If any of the following rope conditions occur, remove the rope from service.

— Excessive contact with dirt and grime
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— Contact with any form of chemical, which could ruin the rope (i.e., acid, petroleum, and vapors)

— Visible damage is evident to the fibers on the outer jacket

— Inner core is visible

— Exposure to temperatures in excess of 250° F

— A load fall is absorbed by the rope

— An excessive load was hauled by the rope (greater than 50% of tensile strength)

— An object has fallen on the rope from an extreme height or at extreme speeds

*Note: The history of a rope is important. Any rope subjected to sustained loads, shock loads, or loads three times the recommended working load should be downgraded or discarded.*

Consult the Scene or Department Safety Officer before re-using a rope that has experienced one of these conditions during an incident. It may not withstand any weight due to weakening from the fault. The rope should be retired if it is unsafe to use in further life and property saving operations.

**Ropes Should Be Retired When:**

— There is excessive sheath wear

— More than 50% of the fibers are broken in one pique

— More than 30% of the fibers are broken over a larger area of the rope

— After a severe shock load or fall load

— Contaminated by chemicals

— An inspection reveals any obvious damage

— The manufacturers "shelf life" of the rope has expired

**Taking a Rope Out of Service**
If a rope has sustained damage (as listed above) the rope will need to be taken out of service. To take a life safety line out of service, cut the ends off of the rope and place the rope in the equipment cache. Most ropes sustain damage to a specific area. The damaged area can be removed and the rope can be placed back in service as a utility line.

**Rope Log**

A Rope Log for recording the usage of each rescue rope must be maintained. The Rope Log is kept in the unit directory. Information to be recorded may include:

- Purchase date
- In Service Date
- Manufacturer
- Size
- Length
- Type of rope
- Washings
  
  Any type of damage
  Any unusual loading
  Whether it sustained a "fall load" or a "shock load"
  Whether an object fell on the rope
  What materials or contaminants the rope came into contact with

Every time a rope is used, the usage should be recorded in the Rope Log (Equipment Form 20). The decision to retire a rope will be determined by reviewing the Rope Log, inspecting the rope for damage, and by using common sense and good judgment.

The Rope Log for each unit shall be kept in the same compartment as the rope. It shall be adhered to the wall in a protective folder and be clearly labeled to encourage its use. Anytime the rope is used (training, rescue, probationary classes etc.) the Rope Log must be filed out. In the case of an on-duty rope accident the Rope Log may sequestered by an investigative body. Do not store the Rope Log in the cab of the engine. If it is out of sight, it will be out of mind.

Equipment form 20 can be found at the following location:


**Washing Rope and Webbing**

When ropes become visibly soiled or it is determined that they need routine cleaning the rope should be tied into a loose daisy chain, placed into the station extractor and cleaned on the “rope” setting. The rope setting has 2 rinse cycles that ensure excess chemicals are removed by the time the wash is complete. 4 oz. of Citro-Squeeze should be added during the washing cycle. Citro-Squeeze has been used to clean fire service rope for over 20 years. A small study conducted in 2003 by Solutions Safety Products (the manufacturer of Citro-Squeeze) and New England Ropes found that washing rope with Citro-Squeeze actually increased tinsel strength 3-5% by cleaning and lubricating the
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rope’s fibers. New England Ropes does not recommend using any additional fabric softeners or detergents, as they have not been tested and cannot be proven to be safe.

Air-dry ropes in a cool, dark place. The station hose tower or apparatus bay are ideal areas. DO NOT dry rope or webbing in the sun because the ultraviolet rays will attack the nylon. At the scene of an incident, ropes may be stuffed in the bags wet if necessary. However, they will need re-washing and proper drying later. Ensure rope is entirely dry before placing back into the rope bag to avoid mold and premature rot.

Annual Rope Maintenance

Ropes are not frequently used in day to day operations, as such they can collect dirt and road grime while in their assigned compartment. To combat undue wear, it shall be the practice of the Escondido Fire Department to annually wash each life-safety rope and its bag. This maintenance program shall be coordinated by the Rope Rescue Program Manager. Upon completion of each unit’s annual rope maintenance, the Annual Rope Maintenance Log (Equipment for 19.0) shall be digitally completed and emailed to the Rope Rescue Program Manager. The document will remain on file indefinitely.

Equipment for 19.0 can be found at the following location:


Remember, dirt left on rope and associated hardware can cause rapid wear. Rope bags will protect a rope from abrasion and exposure to unwanted chemicals. As a final rule, always inspect your rope for damage each time it is used and again as it is being recoiled or bagged.