

# STANDARDS FOR STRENGTH AND USAGE

## NEW ROPE TENSILE STRENGTHS

New rope tensile strengths are based on tests of new and unused rope of standard construction in accordance with manufacturer's Standard Test Methods. It can be expected that strengths will decrease as soon as a rope is put into use. Because of the wide range of rope use, changes in rope conditions, exposure to the many factors affecting rope behavior, and the possibility of risk to life and property, it is impossible to cover all aspects of rope applications or to make blanket recommendations as to working loads.

## WORKING LOAD

Working loads are for rope in good condition with appropriate splices, in noncritical applications and under normal service conditions. Working loads are based on a percentage of the approximate breaking strength of new and unused rope of current manufacture. For our arborist rope products, when used under normal conditions, the working load percentage is 20% of published strengths for rigging lines and 10% for climbing. Normal working loads do not cover dynamic conditions such as shock loads or sustained loads, nor do they cover where life, limb or valuable property are involved. In these cases a lower working load must be used.

A higher working load may be selected only with expert knowledge of conditions and professional estimates of risk, if the rope has been inspected and found to be in good condition, and if the rope has not been subject to dynamic loading (such as sudden drops, snubs or pick-ups), excessive use, elevated temperatures, or extended periods under load.

## NORMAL WORKING LOADS

Normal working loads are not applicable when rope has been subject to dynamic loading. Whenever a load is picked up, stopped, moved or swung there is an increased force due to dynamic loading. The more rapidly or suddenly such actions occur, the greater the increase will be. In extreme cases, the force put on the rope may be two, three, or even more times the normal load involved. Examples could be ropes used as a tow line, picking up a load on a slack line, or using rope to stop a falling object. Dynamic effects are greater on a low elongation rope such as polyester than on a high elongation rope such as nylon, and greater on a short rope than on a long one. Therefore, in all such applications normal working loads as given do not apply, for more information see page 24.

## ROPE INSPECTION

Avoid using rope that shows signs of aging and wear. If in doubt, destroy the used rope. No type of visual inspection can be guaranteed to accurately and precisely determine the actual residual strength. When the fibers show wear in any given area, the rope should be re-spliced, downgraded, or replaced. Check the line regularly for frayed strands and broken yarns. Pulled strands should be re-threaded into the rope if possible. A pulled strand can snag on a foreign object during rope operation. Both outer and inner rope fibers contribute to the strength of the rope. When either is worn, the rope is naturally weakened. Open the strands of the rope and look for powdered fiber, which is one sign of internal wear. A heavily used rope will often become compacted or hard, which indicates reduced strength. The rope should be discarded if this condition exists.

## AVOID OVERHEATING

Heat can seriously affect the strength of synthetic ropes. The temperatures at which 50 percent strength loss can occur are: Polypropylene 250° F, Nylon 350° F, Polyester 350° F. When using rope where the temperature exceeds these levels (or if it is too hot to hold), consult the manufacturer for recommendations as to the size and type of rope for the proposed continuous heat exposure conditions. When using ropes on a capstan or winch, care should be exercised to avoid surging while the capstan or winch head is rotating. The friction from this slippage causes localized overheating that can melt or fuse synthetic fibers, resulting in severe loss of tensile strength.

## STORAGE

All rope should be stored clean, dry, out of direct sunlight, and away from extreme heat. It should be kept off the floor on racks to provide ventilation underneath. Never store rope on a concrete or dirt floor, and under no circumstances should cordage and acid or alkalis be kept in the same vicinity. Some synthetic rope (in particular polypropylene or polyethylene) may be severely weakened by prolonged exposure to ultraviolet (UV) rays unless specifically stabilized and/or pigmented to increase UV resistance. UV degradation is indicated by discoloration and the presence of splinters and slivers on the surface of the rope.

## DYNAMIC LOADING

For dynamic loading applications involving severe exposure conditions, or for recommendations on special applications, consult the manufacturer. For more information see page 24.

## DANGER TO PERSONNEL

Persons should be warned against the serious danger of standing in line with a rope under tension. Should the rope part, it may recoil with considerable force. In all cases where any such risks are present, or if there is any question about the loads involved or the condition of use, the working load should be substantially reduced and the rope properly inspected before every use.

## AVOID ABRASIVE CONDITIONS

All rope will be severely damaged if subjected to rough surfaces or sharp edges. Chocks, bits, winches, drums and other surfaces must be kept in good condition and free of burrs and rust. Pulleys must be free to rotate and should be of proper size to avoid excessive wear.

## SPLICING AND KNOTS

Splices should be used instead of knots whenever possible because knots can decrease rope strength up to 50%. When splices are used, always use the manufacturer's recommended splicing procedures. When knots are used, be sure to take into consideration the knot's corresponding reduction to the rope strength and adjust your working load accordingly. For more information please see the Knots and Rigging section, pages 13 thru 14.

## WINCHING LINES

Braided rope can develop a twist when constantly used on a winch. This makes handling more difficult; the rope should be relaxed and rotated in the opposite direction to remove a twist. To avoid this condition, the direction of turns over the winch should be alternated regularly.

## AVOID CHEMICAL EXPOSURE

Rope is subject to damage by chemicals. Consult the manufacturer for specific chemical exposure, such as solvents, acids, and alkalis. Consult the manufacturer for recommendations when a rope will be used where chemical exposure (either fumes or actual contact) can occur.