

HELICOPTER SYNTHETIC LONGLINE

1. REQUIREMENTS

a. Material Type. Helicopter synthetic longlines shall be constructed from the HMWPE or HMPE (High Molecular Weight Polyethylene) family of rope fibers including brand names such as Spectra by Allied Signal or fibers with similar properties. Spectra has very high strength, high flex fatigue life, very low stretch (less than 1 percent elongation at 30 percent of break strength), excellent chemical resistance, and less than 1 percent water absorption. Another high strength, high performance rope fiber is Vectran produced by Hoechst-Celanese. Rope brand names made from these types of fibers include Plasma 12, Spectron II, and Spectron 12 or AmSteel. Ropes from these fibers are usually twelve-strand or double-braid construction.

b. Rope Diameter. Minimum rope diameter shall be ½-inch.

c. Working or Rated Load. The working or rated load of a rope is the maximum static load that shall be lifted by the rope. Working loads are based on a percentage of the approximate breaking or ultimate strength of the rope when new and unused. The working load shall be appropriate to the lifting capability of the helicopter. For reference, lifting capability for each category of helicopter is as follows:

Type 1: 8,000 lb to 30,000 lb or greater

Type 2: 1,600 lb to 4,500 lb

Type 3: 750 lb to 1,600 lb

d. Factor of Safety. A factor of safety of 7 shall be used for helicopter synthetic longlines. Therefore, all ropes shall have an ultimate strength (minimum breaking strength) of seven times the rated or working load. For example, if a Type II helicopter line shall have a working load of 4,500 pounds, the rope must have a minimum breaking strength when new of at least 31,500 pounds. Rope diameters shall vary depending on strength and type of rope.

e. Knots and Splices. No knots are permitted in the synthetic longline. Knots can decrease rope strength by as much as 50 percent. Splices may be used in the assembly of the longline, but no mid-line splicing repairs may be done. Resplicing at the end of the line is permitted only if the rope is in good condition and the new splice is done per the manufacturer's recommended splicing practices. Splices should always follow the manufacturer's recommended splicing practices.

f. Protective Coatings and Covers. Rope manufacturers offer protective coatings such as aromatic urethane coatings, which help with abrasion resistance and provide some UV protection. The coating appears as a dye on the rope and does not change the rope dimension. Heavy plastic coatings are not recommended because the inside of the rope cannot be inspected. Some companies also sell "sleeve" covers that attach with Velcro. These are easily removable for rope inspection and provide the greatest UV and debris protection. It is recommended but not required that synthetic longlines have the UV coating and/or the removable covers to help protect the lines. Consult rope manufacturers for acceptable coating methods.

2. CARE AND USAGE

a. Heat. Rope strength can be seriously decreased by heat exposure. The critical temperature of rope is the temperature at which 50 percent strength loss can occur. The critical temperature of HMWPE-type ropes is only 150 °F, and melting temperature is 297 °F. Critical temperatures for other types of rope are: Polypropylene 250 °F, Kevlar 400 °F, Nylon 350 °F, Polyester 350 °F.

b. Chemicals and Dirt. Chemicals can cause damage to rope. Keep ropes away from acids, bleach, and solvents. Laundry detergents can also weaken rope, and ropes should only be rinsed if cleaning is needed. Grit from mud, dirt, and sand can work into the rope fibers and cause deterioration. It is difficult to inspect for any debris that has worked its way inside the rope fibers. It is important to keep ropes clean.

c. Ultraviolet. Ultraviolet (UV) exposure causes degradation in rope strength. According to the American Group, a rope manufacturer, the AmSteel fibers lose approximately 30 percent of their strength after 5 or 6 months of sun exposure.

d. Storage. In addition to keeping the rope away from heat, ropes should be stored clean, dry, and out of direct sunlight. Helicopter synthetic longlines should be stored in a rope bag away from batteries and chemicals. If ropes are wet, ideal storage is off the floor on racks to provide ventilation. Never store rope on concrete or dirt floors. Grit from dirt can abrade and weaken rope fibers. Acid is often used in concrete work and can remain on the surface. Abrasive surfaces should also be avoided. Never step on rope, drive over rope, or allow the helicopter to land on the rope. If any of these occur, inspect the line for damage and enter the event in the rope log.

e. Shock Loads. A line is shock- or impact-loaded when it suddenly changes from no load or low load to high load. The further the load falls, the greater the impact. Since synthetic fibers have a memory, the effects of shock loading remain with time and can result in failure even when loaded within the normal range. Any shock loading noticed by the pilot or crew should be recorded in the log.

3. DOCUMENTATION

All synthetic longlines shall be assigned a unique identification number that shall be retired with the longline. Synthetic longlines shall be permanently and legibly marked with a unique identification number, the rated load of the line, name of rope manufacturer, rope lot number, and line manufacture date. A documented history of each synthetic longline must be maintained from the date of purchase until its retirement from service. A rope log shall be assigned to each synthetic longline to record the rope history. The following minimum items shall be recorded in the rope log:

- Manufacture date
- Date put into service
- Rope ID number
- Date of external load and/or inspection
- Approximate weight of load lifted
- Number of lifts per day at each weight
- Remarks/problems
- Inspector signature/initial

Examples of items to note in the remarks/problems section could include any unusual shock loading noticed by the pilot or crew, exposure to chemicals or excessive dirt, problems such as the rope landed on by the helicopter skid, or any irregularities found during inspection.

4. RETIREMENT AND INSPECTION

No visual inspection can accurately determine residual strength. Avoid using rope that shows sign of aging and wear. If in doubt, destroy the used rope. Rope should be inspected after each day of use.

a. Abrasion. All rope fibers contribute to rope strength. When either the outer or inner fibers are worn, rope strength is reduced. Check the line regularly for frayed and broken strands. Rethread pulled strands into the rope if possible. Open the rope strands to look for powdered fiber that is a sign of internal wear.

b. Compacted Rope. Ropes can become hard or compacted when heavily used. Any rope that has become hard or compacted indicates reduced strength and should be discarded.

c. Heat Damage. Glazed or glossy areas indicate heat damage and decreased strength. Even normal looking fibers adjacent to the visibly heat-damaged areas have been damaged.

d. Inconsistent Diameter. Flat areas, lumps, or bumps can indicate internal damage from overloading and usually indicate reason to replace the rope.

e. Discoloration. All ropes shall get dirty. Check for unusual discoloration that could indicate chemical contamination. Determine source of contamination and replace the rope if it is brittle or stiff.

f. Splice Movement. For a buried eye splice (typical splice for lines under $\frac{3}{4}$ -inch in diameter), unacceptable splice slippage would be approximately 2 inches maximum. Tuck splices typically found on larger diameter ropes are also limited to 2-inch maximum slippage.

g. Rope Inspection Check List. If any of these conditions are met, discard the rope:

Condition:

1. Original rope bulk reduced by abrasion:
 - Double braid cover by 50 percent
 - Twelve-strand braid by 25 percent
 - Eight-strand plait by 25 percent
2. Fiber strands cut:
 - Double braid by three or more adjacent strands cut
 - Twelve-strand braid by two or more adjacent strands cut
 - Eight-strand plait by one or more adjacent strands cut
3. Diameter inconsistency:
 - Localized diameter reduction
 - Flat areas
 - Lumps and bumps in rope
4. Glossy or glazed fiber:
 - Localized or extended areas
5. Inconsistency of texture:
 - Localized or extended areas or stiffness
6. Discoloration:
 - Localized or extended areas caused by chemical contamination
7. Splice slippage:
 - Maximum slippage of 2 inches

h. Retirement. No rope shall be used more than 5 years after its manufacture date and no more than 3 years after its put-in-service date.