SAMSON
TECHNICAL
BULLETIN

The Effect of Twist on Braided Ropes

Overview Twist reduces the strength of a braided rope and can lead to unexpected failures. In order to avoid this, it is important to be able to identify twist in a rope, take appropriate actions to remove it from the line, and prevent further twisting.

Braided vs Laid Ropes

BRAIDED ROPE CONSTRUCTION All braided ropes, including 8-strand, 12-strand single braids, double braids, and core-dependent double braids, are constructed from an equal number of "S-strands," or strands that twist to the left, and "Z-strands," or strands that twist to the right. This creates a balanced, or torque-neutral construction that will not naturally twist while under load. In order for a rope to maximize its full-strength potential, all strands of the rope must share the load equally. This load sharing (and thus the strength of the rope) is reduced when a rope is twisted.

LAID ROPE CONSTRUCTION Laid ropes, such as 3-strand, 6-strand, and wire rope constructions, are not torque neutral at all loads. Laid ropes can be "torque balanced" at a specific load range, however this will not eliminate all untwisting while the rope is loaded. As a load is applied to a laid rope, the rope will naturally untwist until it reaches a torque-balanced state.

Why does Twist Reduce the Strength of a Braided Rope?

As a braided rope, that has been twisted, is loaded, the strands become loaded unequally. Depending on the direction of twist either the S- or Z-strands will take more of the load.

Figure 1 illustrates this phenomenon, where all of the Z-strands are tight and all of the S-strands are loose. The loose S-strands will not bear the same load as the tight Z-strands. The tight strands will carry more load than the loose strands leading to a loss in rope efficiency.

Effect of Twist on Rope Strength

Rope strength is decreased with the amount of twist induced into the rope. The effect of twist varies with the fiber type, diameter, and construction of the rope.

Figure 2 shows 24 mm (1" diameter) *AmSteel®-Blue* a 12-strand single braid construction, to illustrate how little twist it takes to affect the strength of the rope.

Mooring lines with twist induced.

FIGURE 1 The loose strands at the top of the rope do not contribute to the strength of the rope. The tight strands at the bottom of the picture bear most of the load.

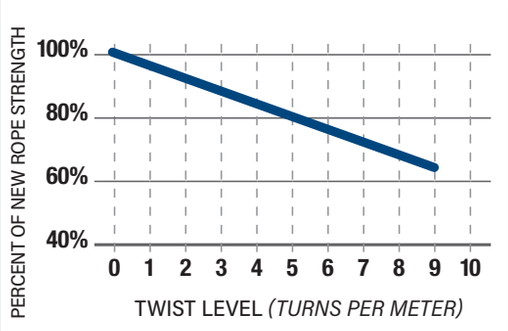

FIGURE 2 Rope strength vs twist.

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The Effect of Twist on Braided Ropes

Identifying Twist

Identifying twist in a braided rope is relatively easy. Simply follow a single line of picks (or crowns) down the length of the rope (see Fig. 3). If the picks form a straight line parallel to the length of the rope, there is no twist. If the line of picks spirals around the circumference of the rope, that section of rope is twisted.

Causes of Twist in a Braided Rope

Although a braided rope will not twist on its own under load like a laid rope, there are various ways a braided rope can become twisted; for example when it is attached to a laid synthetic or wire rope. As a laid rope is loaded, it unwinds, transferring twist to the braided rope component.

> To prevent twist, do not connect a braided rope to a laid rope or wire rope

It is also important to handle the rope correctly and not introduce twist into the line.

Improper reeling or unreeling of a rope can cause twist. Rope should never be taken from a reel lying on its end. It is best to support the reel horizontally so it may spin freely and then pull the rope off the top (see Fig. 4).

> The spinning of a load while lifting or pulling will cause twist in the rope.

Removing Twist

If a twisted line has been identified, take the following steps to remove the twist:

1. Pay out as much of the twisted section of rope as possible onto a flat surface.
2. Manually untwist the line by flipping the eye repeatedly in the opposite direction of the twist until the twist is removed.
3. It may be necessary to milk the twist to the end of the line for the best results.
4. Wind the line back onto the winch or spool under reasonable tension taking care to prevent re-twisting of the line.
5. If the strands appear damaged or the twist is impossible to remove, contact a Samson representative for advice.

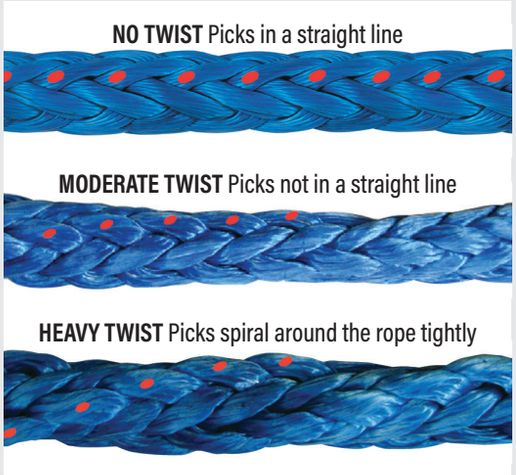
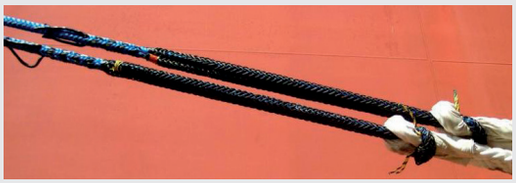


FIGURE 3 Twist in a rope is identified by the alignment of the picks.



Using a braided pendant with a braided mainline will reduce the likelihood of twisting the mainline.

Using a swivel to connect the messenger line to the mainline or pendant can reduce twist in the pendant and mainline.

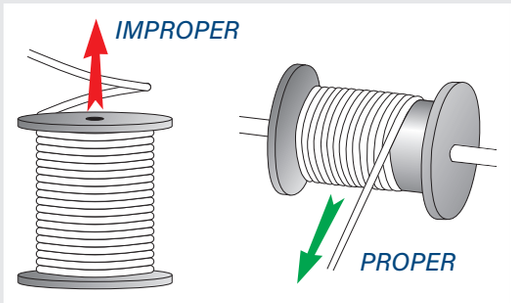


FIGURE 4 Improper reeling or unreeling of a rope can cause twist.

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