Misrepresented Imported Fiber Rope

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Abstract

Several incidents of misrepresented imported fiber rope have come to the attention of the Cordage Institute. These include: 8-strand polypropylene rope which contained filler material and as a result had a significantly reduced break strength, 8-strand "nylon" rope which also contained polyester fiber and as a result had lower break strength and lower stretch than pure nylon rope, and manila rope which was marketed as a specific size but which was under-size and under-strength. These misrepresented products pose safety hazards when they are used for their intended purposes.

This paper describes these deceptive products, explains why they are hazards, and discusses how to identify and how to avoid such misrepresented fiber rope products.

Introduction

Over the last year the Cordage Institute has received complaints about and samples of rope that failed to meet implied or stated size, fiber content and quality.

This paper presents several examples of misrepresented products. These examples describe the misrepresented product and demonstrate how to avoid or detect them. They also give insight into how the misrepresented products might cause accidents, injuries, and death.

The three examples are:

* Use of a filler material inside a polypropylene rope which does not contribute to strength. The outward appearance is identical but the break strength is only about 1/3rd that of a commonly used mooring rope.

* Mixing nylon and polyester fibers and representing it as a nylon rope. This mixture reduces the break strength and drastically reduces the elongation and energy absorption of a commonly used towing rope.

* Mislabeling or misrepresenting the actual size of a manila rope and thus implying it has a higher break strength (and a greater value).

The Cordage Institute (CI) rope standards and test methods are developed and agreed to by experts in the CI Technical Committee. They are then balloted and agreed to through a consensus procedure by CI member companies and others who choose to participate in the balloting process. The CI standards cover most types of rope which are sold commercially. Presently 38 CI standards and guidelines are available. They are available

from the Cordage Institute office and on the CI web site, at the addresses given at the end of this paper. (ref 1) (ref. 2)

Adherence to CI standards is not required, even by CI member companies, unless it is stated or implied that the rope product is made in accordance with a CI standard. And adherence can be required if a rope buyer specifies a CI standard.

The reason for this paper is to raise user's awareness of potential problems and hazards when buying and using substandard fiber rope products. This paper also give users tools to detect the products so that accidents may be avoided.

This paper is not intended to bash imports. The majority of the ropes imported into the United States are good quality and meet or exceed Cordage Institute or other implied standards.

At this time, fiber rope products are not required to have country of origin labels, other than on the original packaging. Thus it can be difficult to identify the country of origin, especially after the rope has been placed in service. Also, although all of the misidentified rope products discussed in this paper, and all such ropes recently brought to the attention of CI, have been imported, similar problems can occur with domestic ropes.

The tests and examinations reported on in this paper were conducted by the author at Southwest Ocean Services, Inc., Houston, TX. Some initial tests and examinations were conducted by other companies before bringing the problems to the attention of CI.

A Counterfeit Polypropylene Mooring Rope

3-strand polypropylene rope, typically with two yellow strands and one black strand, is commonly used for barge mooring and towing applications on the Gulf Coast. Several suppliers and users reported to CI that an imported rope product had the outward appearance of this polypropylene rope but was not a true polypropylene rope.

We examined a sample of the rope and found the core of each strand had a non-woven cloth filler. Fig. 1 is a photo of a rope strand unraveled to revealing the blue filler material. This filler added to the bulk of the rope but did not contribute to the strength. The product was sold as a 2 inch dia. 3-strand polypropylene rope. The CI standard 1301 states that the minimum break strength of such polypropylene 3 strand rope is 49,800 lbs. (ref. 3)

We then tested a sample of the product using the CI 1500 "Method of Testing Fiber Rope". (ref. 4) Fig. 2 shows the test record. The break strength was 14,115 lbs. This is just 30% of the required minimum strength in the CI 1301 standard.

Fig. 3 shows the outward appearances of the deceptive "polypropylene" rope and a normal yellow-black polypropylene rope, typically used on barges and tow boats. We are concerned about the safety aspect of this deceptive rope.

A deck hand on a barge or tow boat might not know the break strength of the yellow-black polypropylene rope. But he will know under what circumstances such a rope which looks like can be safely used. If he used the counterfeit "look alike" product in the normal manner, it would not last long. It would break and could cause injury or death.

Fortunately this deceitful-appearing rope was revealed before any accident, and the importer then recalled the entire product.

Polyester in Nylon Clothing

This deceitful product is the most difficult to detect and yet is the most prevalent in the market place today. It is commonly identified as 8-strand nylon rope, but it is only part nylon. The rest is polyester, and that causes it to have a lower break strength and a lower stretch to break than 100% nylon rope.

The size range from 2" diameter (6" circumference) to 5" diameter (15" circumference). This is especially a potential safety problem because the rope is used in high tension and critical situations.

Recently a "nylon" towing surge line broke while in use in the Gulf of Mexico. The rope had only been in service for a short time. The towing company had the supplier do a residual break test. The break was about 40% less than new rope break strength. And the stretch at break was very low.

The supplier then provided a specimen of unused rope from the remainder of the coil to CI for analysis and testing. We discovered that only half the fibers in the rope were actually nylon, and the rest were polyester. This new "nylon" rope broke at 79% of the minimum break strength required by CI 1303, the standard for 3 & 8-strand nylon rope. (ref. 5) At break this "nylon" rope only stretched 14.6%, while the typical stretch to break of a genuine nylon rope, in new condition on first loading, is typically more than 30%.

We then examined a number of other alleged "nylon" ropes on the market. The ratio of polyester ranged from 50% to 96%. One such "nylon" rope was 100% polyester, but this might have been mislabeled. Most of the ropes had nylon and polyester fiber twisted together in each rope yarn. Some had a nylon core with polyester wrapped around as the outer layer. The 96% polyester rope just had 4 rope yarns of nylon in the center of each strand.

When fibers of different materials, with different stretch characteristics, are unscientifically mixed together in the same rope product, the fibers don't equally share the load. In this case, the stiffer polyester fibers take most of the load, until they break. At that moment, the load is suddenly transferred to the nylon fibers, and the rope usually immediately fails. The nylon contributes almost nothing, and the break strength might only be proportional to the percent of polyester in the rope.

What is more dangerous is that the stretch to break is much less than for a true nylon rope. Because it has more stretch and absorbs more energy than polyester, nylon rope is commonly used as a surge line, or shock absorber, in parallel with wire tow lines. This lessens the load on and increases the life of the wire rope. Nylon rope is also commonly used by itself as a tow line.

If a mixed nylon and polyester rope is used in these towing applications, there is great risk that the tow rope will fail, resulting in loss of the tow and possibly resulting in injury or death due to recoil of the broken rope.

How can you tell if the rope is not 100% nylon? Unfortunately, nylon and polyester fibers look very much alike, even to an expert.

But you can run a simple to tell the difference. All that is needed is a 2 quart sauce pan, a hot plate or stove, a package of black Rit Dye, and water. The Rit Dye can be purchased at any grocery store. Wear plastic or rubber gloves when conducting the test. Remove about 12" of one strand from the rope and tape one (but only one) end. Fill the sauce pan with fresh tap water and add the dye. Bring this to a boil. Dip the untapped end of the strand into the boiling dye solution for between about 10 to 30 seconds. Remove the rope and immediately rinse it in cold tap water while squeezing the strand fibers. The dye will wash off of the polyester fibers and soak into the nylon fibers. If all of the fibers are nylon, it is genuine. If some of the fibers remain white, these are polyester, and it is not a genuine nylon rope.

If you discover that the rope is part polyester, will the supplier refund your money? If you asked for a nylon rope but did not require that it meet the applicable CI (or similar) standard, he might claim that part of it is nylon, and refuse to give you a refund.

Under-Size (and Under-Strength) Manila Rope

3-strand manila (abaca fiber) rope is still commonly used for many purposes. Even in undemanding, low-tech service, the strength of the manila rope may be important and even critical. Property and even life sometimes depends on it.

All of this product imported, most from the Philippines. The CI has a standard for manila rope, "CI-1308". (ref. 6) But an old government standard for manila rope, T-R-605b, issued in December, 1963, is the generally accepted standard for manila rope. (ref. 7). For example, until recently, the state of California referred to it in their truck cargo tie-down regulations. (ref. 8)

It is not required that all manila rope meet either of those standard. But if the packing container or rope label states made in accordance with T-R-605b or CI-1308, the customer has the right to expect reasonable compliance.

The stated size of most commercial fiber rope is only a nominal value for the diameter. The stated size relates to a weight per unit length, which is given in the applicable

standard. For manila rope, T-R-605b and CI-1308 both give the same physical properties.

A common method of deception is to supply undersized manila rope which does not meet the standards, with respect to weight and more importantly with respect to break strength.

We were sent 3 manila rope specimens that came from 3 different shipments. All of these were labeled 1/2 inch diameter. By CI-1308, this size rope should weigh approximately 7 lbs per 100 ft and have a minimum new break strength of 2,385 lbs.

The first shipment met the weight requirement but did not quite meet the minimum break strength requirement. Two out of three breaks were below the required minimum, even though the average of all breaks was above the minimum.

The second shipment did not meet either the weight or minimum break strength requirements. The third shipment was even smaller and weaker.

Some importers are misrepresenting the weight of such manila rope for financial gain. For example, they pay for 3/8 inch rope and ask you to pay for it as 1/2 inch rope. They might import the product in unmarked boxes and then label it with a larger diameter. Or they listing a size range, but the product only meets the smallest of the range.

What Can The User Do?

Buyer beware! The rope user should be knowledgeable about the rope product and the rope supplier. If the price is too good to be true, it probably isn't the true product. (ref. 9)

The rope user should specify that the rope product meet a recognized standard. Or he should at least specify that the rope be 100% of the intended material and have a stated minimum break strength. Without this, then the rope user has little recourse if a substandard rope is delivered.

Insist upon documentation of product quality, and even be skeptical of that documentation. It is not uncommon to receive a "certificate" stating that when the rope was tested it broke exactly at the minimum break strength specified in a CI or some other standard. What is the probability of that happening? Make sure that the certificate was signed by a representative of a trusted test facility or independent agency, and check the date to see if it might be an older certificate for another rope order. For large orders or critical applications, have a sample of the rope break tested in the presence of your inspector or by an independent test facility.

Carefully examine the rope product to assure that it does not contain filler material and that it is made of the intended material. With nylon rope, conduct the simple dye test described above.

Measure the rope diameter. Although diameter is not always a good indication of rope size, it will give an indication of possible under-sizing. If under-sizing is suspected, lay

out the rope in a straight path, apply hand tension, and cut off at least about 10 ft of rope. Weigh this to determine the weight per unit length, and compare this with the table in the applicable rope standard.

If there is a serious question regarding the quality of a fiber rope product, call upon the services of a rope consultant or the Cordage Institute.

Cordage Institute Contacts and Standards

Contact Dave Richards or Pete Lance for a copy of the Cordage Institute Standards list. There is a nominal fee for PDF or hard copies of these standards.

The Cordage Institute
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References:

1) John Flory, Dave Richards, Elizabeth Huntley, and Gale Foster, "Cordage Institute Rope Test Methods, Standards, and Guidelines", *MTS/IEEE Oceans 2004 Conference Proceedings*, IEEE, Piscataway, NJ and MTS, Columbia, MD

2) Cordage Institute Publications Catalog, www.ropecord.com/cordage/publications

3) CI 1301, "Polypropylene Fiber Rope, 3-Strand Laid and 8-Strand Plaited Constructions"

4) CI 1500, "Test Methods for Fiber Rope"

5) CI 1303, "Polyester (PET) Fiber Rope, 3-Strand Laid and 8-Strand Plaited Constructions"

6) CI-1308 "Manila Rope 3-Strand Construction"

7) Federal Specification T-R-605b Rope, Manila and Sisal

8) Title 13, California Code of Regulations, Chapter 7. Loading Regulations Article 1.

9) John Flory, "Know the Ropes, Commodity or Quality", Sea Technology Magazine, June, 2002

Fig. 1 Photo of deceptive "polypropylene" rope, showing blue non-woven cloth filler in interior of strand.

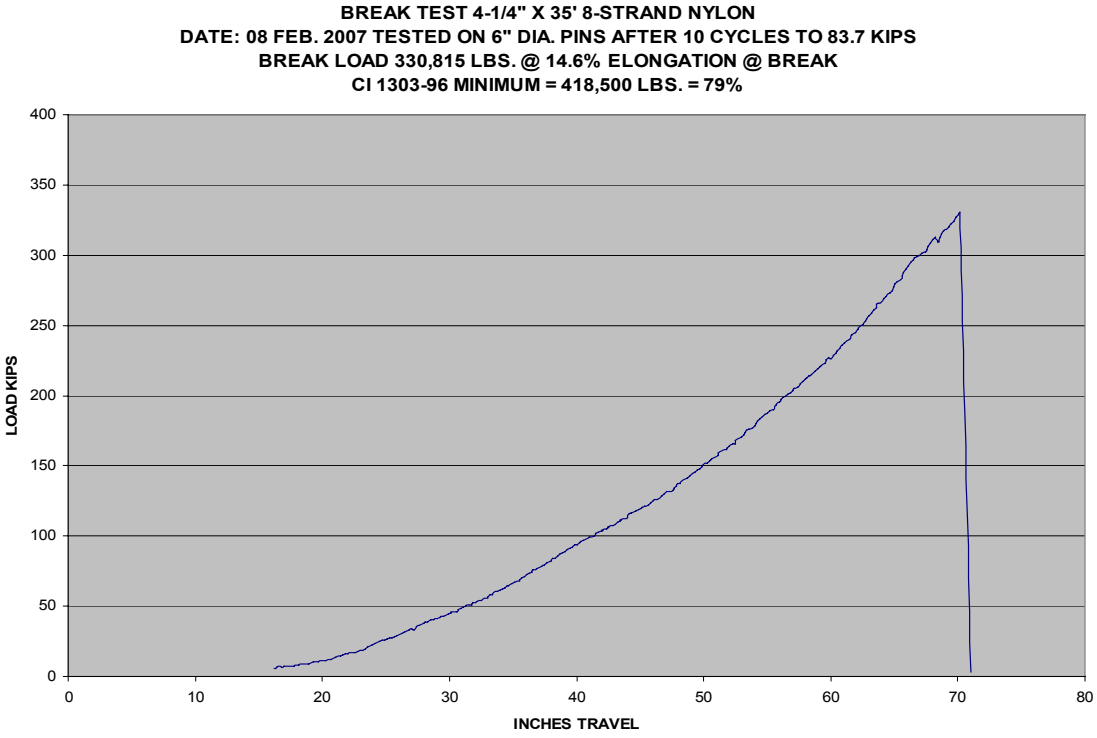

Fig. 2 Graph of break test of deceptive "polypropylene" rope. Broke at 14,115 lbs.

Fig. 3 Top. normal 2 inch dia. polypropylene rope, minimum break strength 49,800 lbs. Bottom, deceptive "polypropylene" rope, actual break strength 14,815 lbs.

Fig. 4 Deceptive "nylon" strand after the dye test. The black strands are nylon, but the white strands are polyester

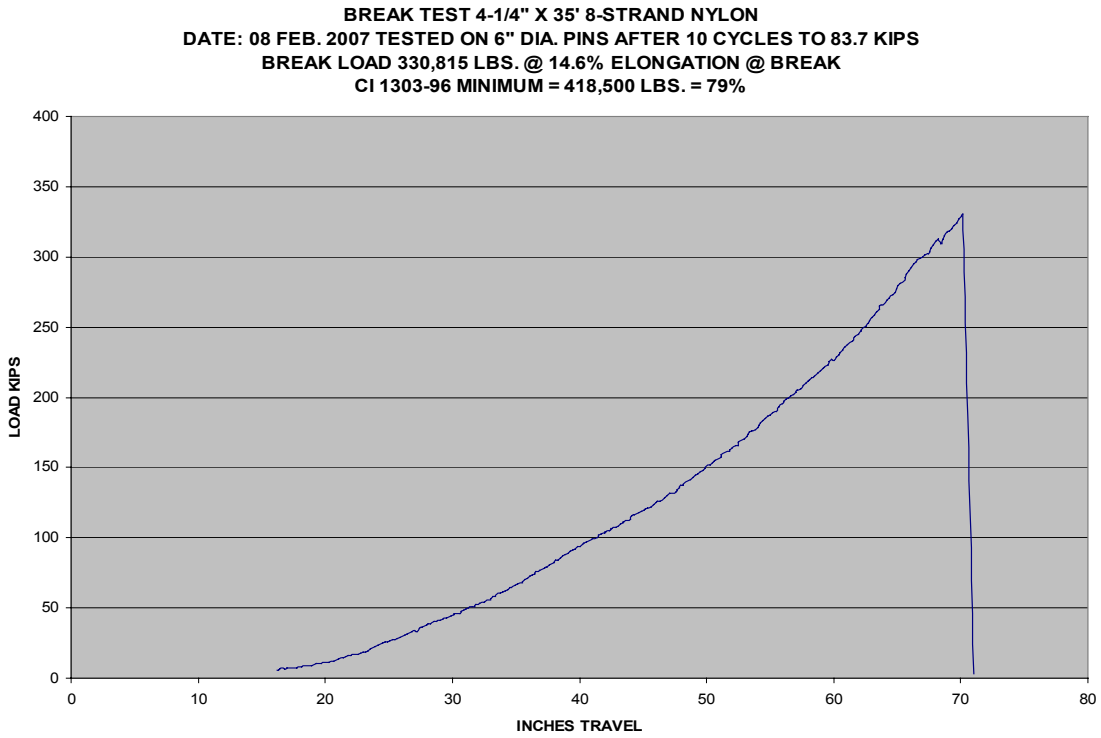

Fig. 5 Load - Stretch Graph of New 50-50 Nylon/Polyester 8-Strand Rope, Posing as Genuine "Nylon" Rope.

Fig. 6 Three Undersize or Understrength 1/2 inch Diameter Manila Rope