Figure D-5 – 8-strand rope showing internal flattening, abrasion, and fusing. (photo credit: TTI)

Figure D-6 - Inter-Strand Abrasion (Exposed internal area reveals wear at strand internal contact points)

Figure D-7 - Inter-Strand Abrasion (exposed internal area reveals fiber to fiber abrasion at braid crossing points.)

Figure D-8 – 8-strand rope opened to show abrasion between strands.

Add “due to cyclic fatigue to the end of the above captions?

6.3 Cyclic Tension Wear (Internal Abrasion)

6.3.1 Ropes that are cycled within a normal working load range will gradually lose strength. This loss of strength may be accelerated if the rope is unloaded to a slack condition or near zero tension between load cycles. The subsequent damage is commonly referred to as fatigue. Although there are various mechanisms for the breakdown of synthetic fibers under cyclic tension, the most common is fiber to fiber abrasion. See Figures D-12 and D-14 as examples of normal wear. See Figures D-05, D-06, D-07, and D-08 where cyclic loading and unloading has caused a breakdown of yarns in the outer surface of the braided ropes. These ropes may also be extremely hard due to internal compaction of broken fibers.

Unirope comment: But Figures D-05, D-06, D-07, and D- show internal abrasion and the captions state that. If ‘cyclic’ fatigue is meant than this should be captioned

Figure D-15 - External abrasion on HPF synthetic braid (photo credit: ISO)

Figure D-16 –Extreme external abrasion wear (photo credit: ISO)

Figure -17 - Extensive external abrasion on a braid (photo credit: ISO)

6.3 Cyclinc Tension Wear (internal Abrasion)

6.3.2 Braided ropes experience broken filaments at the crossover points of strands in the braid due to fiber-on-fiber abrasion. The broken ends of yarns may appear as if cut square (a magnifying glass may be necessary). These broken filaments give the rope a fuzzy appearance on the outside; this can be so extreme as to obscure the underlying braid structure. Figures D-15, D-16 and D-17 shows extreme examples of braided ropes that exhibit excessive damage from frequent loading and unloading.

TIMM's comment: We think that it`s difficult to name D15 as extreme example of excessive damage. Not sure with D16. Agree with D17. (Maybe external) Please refer to appendix D

Unirope comment: Figures D-15, D-16 and D-17 show examples of external abrasion but this pare talked about internal strand-to-strand abrasions in braided rope

SP: suggest changing the text to read D-15, -16, and -17 exhibit different wear levels on a braided rope from frequent loading and unloading.

Figure D-5 – 8-strand rope showing internal flattening, abrasion, and fusing. (photo credit: TTI)

Figure D-6 - Inter-Strand Abrasion (Exposed internal area reveals wear at strand internal contact points)

Figure D-7 - Inter-Strand Abrasion (exposed internal area reveals fiber to fiber abrasion at braid crossing points.)

Figure D-8 – 8-strand rope opened to show abrasion between strands.

6.3 Cyclic Tension Wear (Internal Abrasion)

6.3.1 Ropes that are cycled within a normal working load range will gradually lose strength. This loss of strength may be accelerated if the rope is unloaded to a slack condition or near zero tension between load cycles. The subsequent damage is commonly referred to as fatigue. Although there are various mechanisms for the breakdown of synthetic fibers under cyclic tension, the most common is fiber to fiber abrasion. See Figures D-12 and D-14 as examples of normal wear. See Figures D-05, D-06, D-07, and D-08 where cyclic loading and unloading has caused a breakdown of yarns in the outer surface of the braided ropes. These ropes may also be extremely hard due to internal compaction of broken fibers.

6.3.3 For braided ropes, broken filaments within the rope can also mat, entangle and/or leave a powdery residue (Figures D-05, D-06, D-07, and D-08). Extreme internal filament breakage will make the rope very hard, lose flexibility and be noticeably larger in diameter (with a subsequent reduction in length); it may be so hard that it is impossible to pry the rope open to examine the interior structure. Melted fiber and fusion may be observed in the core rope or between core and cover. See Figure D-04 for exposing the inside of the structure.

Unirope comment: Should the same figures be reference in both 6.3.1 and 6.3.3?

6.3 Cyclic Tension Wear (Internal Abrasion) [C]

6.3.5 Jacketed ropes with a non-load bearing jacket should be examined under the jacket. Broken filaments, powdery residue or fusion may be observed if the interior can be examined.

Unirope comment: No picture for this?

6.4 External Abrasion [D]

6.4.1 The nature of fiber abrasion can be distinguished by the length of protruded fibers. If they broke at the crown of the strand, this was caused by external abrasion. If they are longer and broke between adjacent strands, this was caused by internal abrasion during tension or bend cycling. See Figure 1.

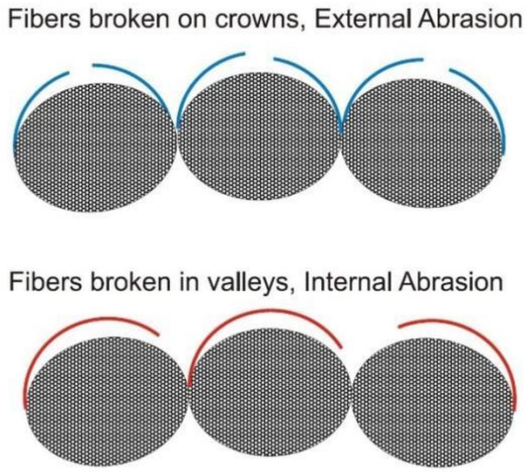

Figure 1 - Braided Rope abrasion damage types

Figure D-11– Localized external abrasion

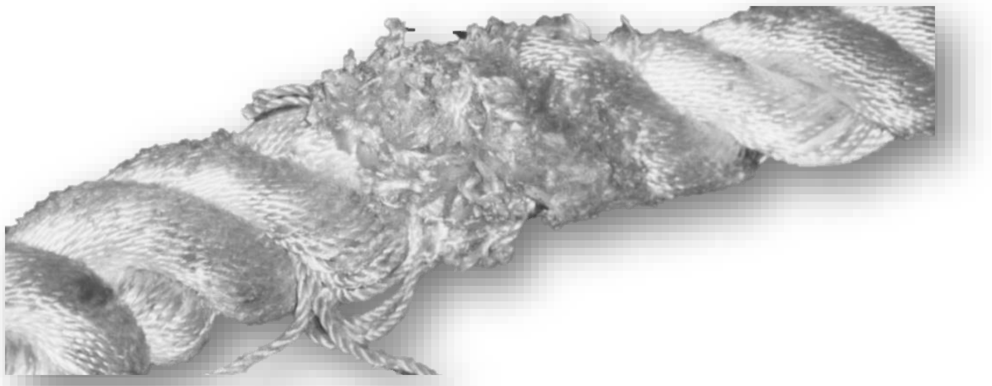

Figure D-18 - Localized external abrasion

Unirope Comment: I doubt that this can be clearly detected by a rope inspector. With wire ropes this can be much more better distinguished. Figure D18 is captioned as 'external' abrasion but the fibers ends are long and point to 'internal' abrasion.

Figure D11 shows a fuzzy or wooly outer surface with NO clear individual recognizable fibers and is labeled as 'external abrasion'. That Figure does not even closely resemble Figure 1 'fibers broken on crown'. This is a very fuzzy matter!

Figure D-41 – Improper splicing of a 12-strand braid

Figure D-43 – Worn-out eye of a balanced double braid (photo credit: Yale Cordage)

Figure D-42 – Top picture of a properly made splice for reference. Bottom picture is slipped splice on a double braid after tension was applied. Core is exposed and colored warmer. (photo credit: Teufelberger)

6.8 Spliced Eyes

6.8.4 Tucks in 3 ,8 strand and tucks in tuck splices in single braided may have slipped in the splice. The buried leg in single and double ropes may have slipped. Freshly exposed fiber in tucks or buried legs will look clean or have a slightly different appearance where it has pulled out of the body of the rope. See Figures D-42, and D-43, an example of a poorly made splice.

Unirope Comment: D-43 shows a worn out eye and not a slipped splice. Take away D-43, use D-41

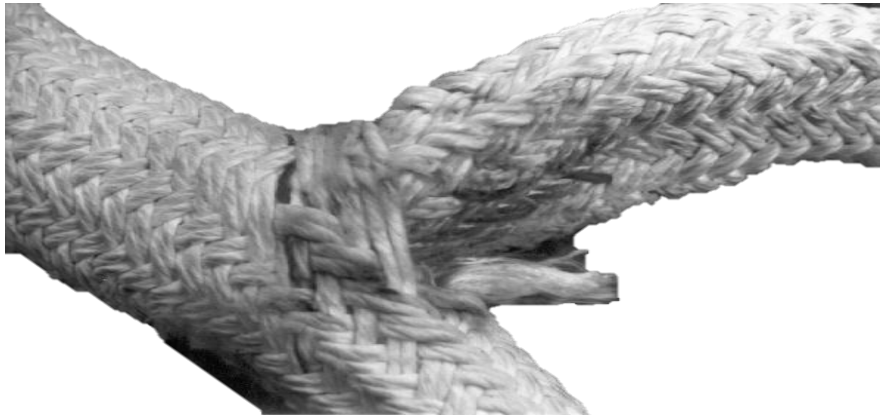

Figure D-45 - Tearing at leg junction of eye splice

Figure D-46 – Thimble with corrosion and bio-fouling. Both pictures are the same thimble/rope taken from different angles.(photo credit: Cortland Company)

6.9 Thimbles

6.9.4 Check for excessive wear within the eye.

Unirope comment: add "See Figure D-45 and D46. to the end of this

Figure D-47 - Core axially compressed causing
winch bumps that can be restored
(photo credit: Yale Cordage)

6.13 Axial Compression and Kink Bands

6.13.2 The rope will exhibit bulges in zones where kinks are concentrated. The bulges often might repeat at a uniform cycle length.

Unirope comment: suggest to reference D-47 for this point.

6.13 Axial Compression and Kink Bands

6.13.5 Kink bands can also appear in splices of very high strength, high modulus ropes. This is an indication that serious damage could be present.

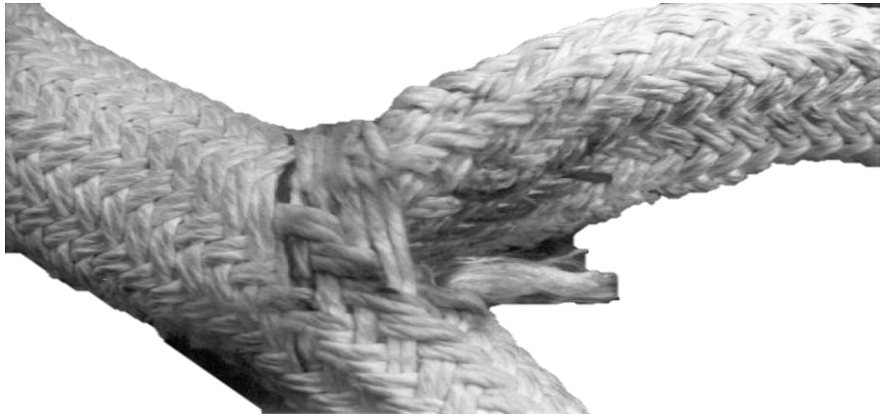

Figure D-45 - Tearing at leg junction of eye splice

Unirope comment: No picture? Can we use D-45?

6.14 Hockle, Twist, Kink or Corkscrew

6.14.4 Braided and plaited ropes which display significant twist should not be used unless restored to normal appearance. See Figures D-53 and D-54

TIMM's comment: As reference should be D-53 (not D-54)

Unirope's comment: Should reference D52 as well, but not D-54

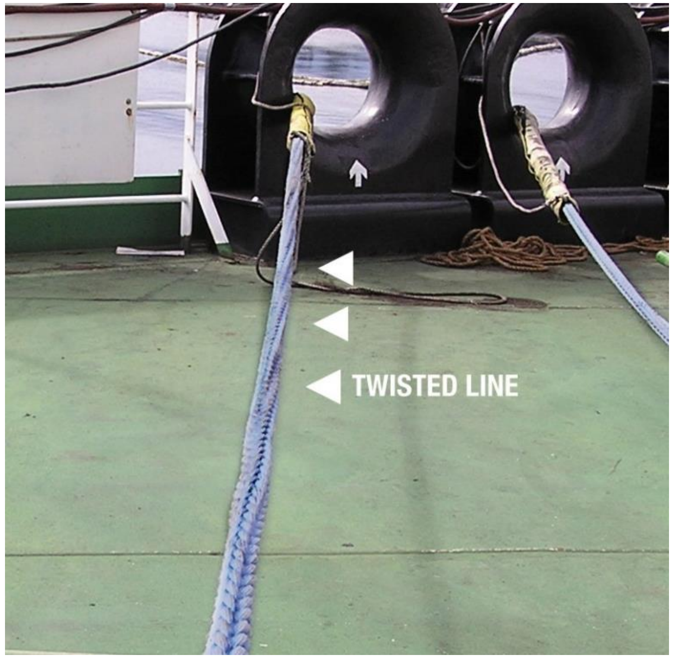

Figure D-53 - Twist in 12-stand braid (photo credit: Samson)

Figure D-54 - Kink

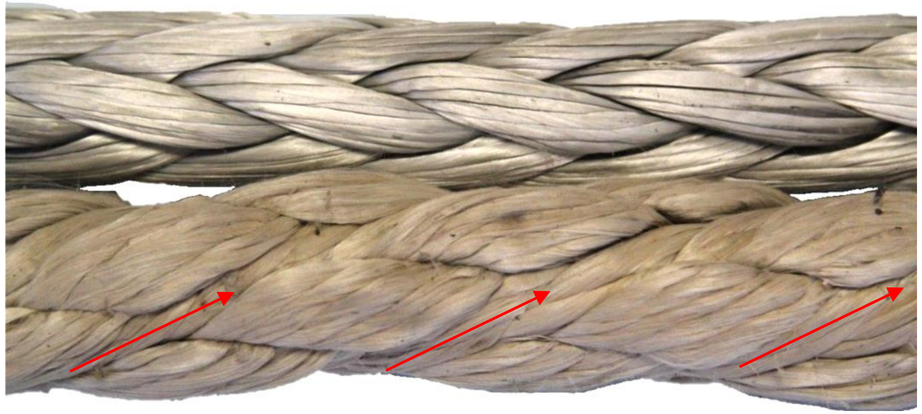

Figure D-52 – Top 12-strand braid is new. Bottom braid is over torqued in the direction of the red arrows. In this example, the left hand or S-strands of the lower braid are carrying more of the load thus severely reducing the rope strength.

Figure D-55 - UV (Sunlight) Degradation of polypropylene rope

Figure D-56 – 8-strand braided rope degraded by sunlight in need of retiring (photo credit: Teufelberger)

Figure D-57 – Braided rope degraded by sunlight

6.15 Sunlight Degradation

6.15.2 Discoloration, brittleness, and weakness in the filaments may be observed in some cases. This degradation can be detected by rubbing the rope with a fingernail. The degradation may present itself visually in the form of splinters or slivers on the surface of the rope.

6.15.3 UV radiation may discolor the fibers or coatings of a rope. Discoloration does not necessarily indicate strength loss.

Unirope comment: suggest adding "See Figures D-55, D-56 and D-57" to the end of both 6.15.2 and 6.15.3

Figure D-33 - Pulled strand in new double braid. Load bearing core is intact.

TIMM Comment: D-33 is picture of double braided (It`s braid, but ...). (In column 1 is “8-strands, Braids”

Do we add Fiber jacketed ropes to this row’s Rope Type?

Rope Type	Damage Description	Sect. Ref	Fig Ref	Repair	Downgrade	Retire
8-strand, Braids	Main strands, less than 15% are pulled out of position a moderate amount and can be worked back into the rope to conform to the original structure. None are broken.	6.6.1 6.6.2	D-33	Yes	No	No

Figure D-56 – 8-strand braided rope degraded by sunlight in need of retiring (photo credit: Teufelberger)

Comment:

We will contribute to this document with pictures, but in a fair way. With fair way, we suggest choose one of these options:

- a. Not credit pictures. This way is to not to change technical document to marketing document.

- b. Credit all who contributed on last page of document.