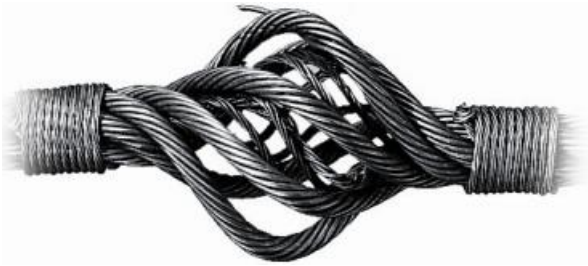
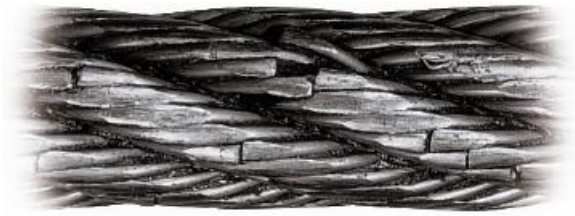
WIRE ROPE WEAR AND REMOVAL CRITERIA

TYPICAL EVIDENCE OF WEAR AND ABUSE



A “birdcage” is caused by sudden release of tension and the resulting rebound of rope. These strands and wires will not be returned to their original positions. The rope should be replaced immediately.

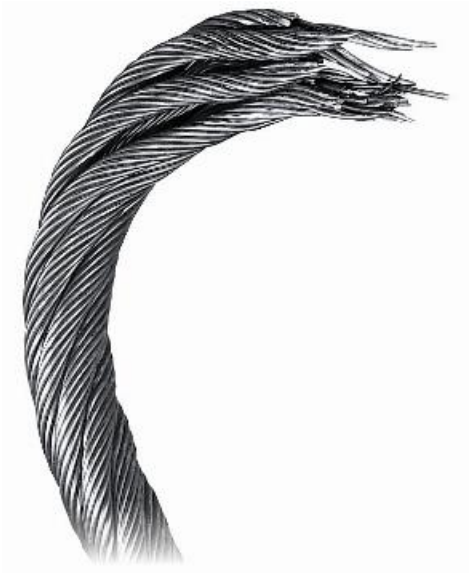


A typical failure of a rotary drill line with a poor cutoff practice. These wires have been subjected to continued peening, causing fatigue type failures. A predetermined, regularly scheduled cutoff practice can help eliminate this type of problem.

This is localized wear over an equalized sheave. The danger here is that it’s invisible during the rope’s operation, and that’s why you need to inspect this portion of an operating rope regularly. The rope should be pulled off the sheave during inspection and bent to check for broken wires.

This is a wire rope with a high strand– a condition in which one or more strands are worn before adjoining strands. This is caused by improper socketing or seizing, kinks or dog-legs. At top, you see a closeup of the concentration of wear. At bottom, you see how it recurs every sixth strand in a 6 strand rope.

This is a wire that has been kinked. It's caused by pulling down a loop in a slack line during handling, installation or operation. Note the distortion of the strands and individual wires. This rope must be replaced.



Here's a wire rope that has jumped a sheave. The rope "curled" as it went over the edge of the sheave. When you study the wires, you'll see two types of breaks here: tensile "cup and cone" breaks and shear breaks that appear to have been cut on an angle.

Drum crushing is caused by small drums, high loads and multiple winding conditions.

REMOVAL CRITERIA

A major portion of any wire rope inspection is the detection of broken wires. The number and type of broken wires are an indication of the rope's general condition and a benchmark for its replacement.

Frequent inspections and written records help determine the rate at which wires are breaking. Replace the rope when the values given in the table below are reached.

Valley wire breaks – where the wire fractures between strands or a broken wire protrudes between strands – are treated differently than those that occur on the outer surface of the rope. When there is more than one valley break, replace the rope.

Broken wire removal criteria cited in many standards and specifications, like those listed below, apply to wire ropes operating on steel sheaves and drums. For wire ropes operating on sheaves and drums made with material other than steel, please contact the sheave, drum or equipment manufacturer or a qualified person for proper broken wire removal criteria.

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OSHA 1926.1413 WIRE ROPE REMOVAL FROM SERVICE CRITERIA

1926.1413(a)
Shift inspection.
1926.1413(a)(1)
A competent person must begin a visual inspection prior to each shift the equipment is used, which must be completed before or during that shift. The inspection must consist of observation of wire ropes (running and standing) that are likely to be in use during the shift for apparent deficiencies, including those listed in paragraph (a)(2) of this section. Untwisting (opening) of wire rope or booming down is not required as part of this inspection.
1926.1413(a)(2)
Apparent deficiencies.
1926.1413(a)(2)(i)
Category I. Apparent deficiencies in this category include the following:
1926.1413(a)(2)(i)(A)
Significant distortion of the wire rope structure such as kinking, crushing, unstranding, bird caging, signs of core failure or steel core protrusion between the outer strands.
1926.1413(a)(2)(i)(B)
Significant corrosion.
1926.1413(a)(2)(i)(C)
Electric arc damage (from a source other than power lines) or heat damage.
1926.1413(a)(2)(i)(D)
Improperly applied end connections.
1926.1413(a)(2)(i)(E)
Significantly corroded, cracked, bent, or worn end connections (such as from severe service).
1926.1413(a)(2)(ii)
Category II. Apparent deficiencies in this category are:
1926.1413(a)(2)(ii)(A)
Visible broken wires, as follows:
1926.1413(a)(2)(ii)(A)(1)
In running wire ropes: Six randomly distributed broken wires in one rope lay or three broken wires in one strand in one rope lay, where a rope lay is the length along the rope in which one strand makes a complete revolution around the rope.
1926.1413(a)(2)(ii)(A)(2)
In rotation resistant ropes: Two randomly distributed broken wires in six rope diameters or four randomly distributed broken wires in 30 rope diameters.
1926.1413(a)(2)(ii)(A)(3)
In pendants or standing wire ropes: More than two broken wires in one rope lay located in rope beyond end connections and/or more than one broken wire in a rope lay located at an end connection.
1926.1413(a)(2)(ii)(B)
A diameter reduction of more than 5% from nominal diameter.
1926.1413(a)(2)(iii)
Category III. Apparent deficiencies in this category include the following:
1926.1413(a)(2)(iii)(A)
In rotation resistant wire rope, core protrusion or other distortion indicating core failure.
1926.1413(a)(2)(iii)(B)
Prior electrical contact with a power line.
1926.1413(a)(2)(iii)(C)
A broken strand.
1926.1413(a)(3)
Critical review items. The competent person must give particular attention to all of the following:
1926.1413(a)(3)(i)
Rotation resistant wire rope in use.

1926.1413(a)(3)(ii)

Wire rope being used for boom hoists and luffing hoists, particularly at reverse bends.

1926.1413(a)(3)(iii)

Wire rope at flange points, crossover points and repetitive pickup points on drums.

1926.1413(a)(3)(iv)

Wire rope at or near terminal ends.

1926.1413(a)(3)(v)

Wire rope in contact with saddles, equalizer sheaves or other sheaves where rope travel is limited.

1926.1413(a)(4)

Removal from service.

1926.1413(a)(4)(i)

If a deficiency in Category I (see paragraph (a)(2)(i) of this section) is identified, an immediate determination must be made by the competent person as to whether the deficiency constitutes a safety hazard. If the deficiency is determined to constitute a safety hazard, operations involving use of the wire rope in question must be prohibited until: