

# Wire rope inspection program

**D**espite their durability and strength, wire ropes will eventually wear out and must be removed after a period of use. That's why regular inspection is crucial.

## HOW OFTEN TO INSPECT

All hoisting lines should be visually inspected at least once each day when in use, as is suggested by American Petroleum Institute (API) RP54 guidelines. Hoisting lines should be thoroughly inspected once each month and a record made of the monthly inspection.

Any wire ropes that have met the following criteria for removal must be immediately replaced. When in doubt, replace. The cost is minimal compared to what could happen if your rope breaks.

## WHEN TO REPLACE RUNNING ROPES DUE TO BROKEN WIRES

Wire ropes used as running ropes other than sand lines should be removed from service when broken wires meet any of the following criteria:

- > For six- and eight-strand constructions, replace when you see six randomly distributed broken wires within one lay length, or three broken wires in one strand within one lay length.
- > For rotation-resistant constructions, replace when you see two randomly distributed broken wires in six rope diameters – or four randomly distributed broken wires in 30 rope diameters.

## FOLLOW THESE STEPS TO INSPECT FOR VALLEY BREAKS

1. The first step is to relax your rope to a stationary position and move the pick-up points off the sheaves. Clean the surface of the rope with a cloth – a wire brush, if necessary – so you can see any breaks.
2. Flex the rope to expose any broken wires hidden in the valleys between the strands.
3. Visually check for any broken wires. One way to check for crown breaks is to run a cloth along the rope to check for possible snags.
4. With an awl, probe between wires and strands and lift any wires that appear loose. Evidence of internal broken wires may require a more extensive rope examination.

For additional information and requirements, please refer to the latest edition of:

- > API RP 2D: Recommended Practice for Operation and Maintenance of Offshore Cranes



Sand lines should be removed from service when you see three broken wires within one lay length.

## WHEN TO REPLACE STANDING ROPES DUE TO BROKEN WIRES

Wire ropes used as standing ropes such as guy lines, escape lines and pendant lines should be removed from service when any of the following conditions exist:

- > Three broken wires are found within one lay length.
- > More than one broken wire is found at the end connection.
- > Broken wires are found in the valleys between the rope's strands.

## WHEN TO REPLACE MAST RAISING LINES DUE TO BROKEN WIRES

- > One broken wire is found anywhere along the length of the mast raising line.

## OTHER REASONS TO REPLACE ROPES

Broken wires are only one way wire ropes wear out. Other conditions for removal of wire rope from service are:

- > Corrosion that pits the wires.
- > Corroded wires at end connections.



**Typical valley (above) and crown (below) wire breaks in outer wires.**

- > API RP 9B: Recommended Practice on Application, Care and Use of Wire Rope for Oilfield Service
- > API RP 54: Recommended Practices for Occupational Safety for Oil and Gas Well Drilling and Servicing Operations
- > ASME B30.5: Mobile and Locomotive Cranes (crane rope removal criteria)



- > End connections that are corroded, cracked, bent, worn or improperly applied.
- > Evidence of kinking, crushing, cutting, bird-caging or a popped core.
- > Wear that exceeds one-third of a wire's original diameter.
- > Severe reduction of the rope's diameter.
- > Evidence of heat damage.
- > A significant increase in lay length.

### HOW TO FIND BROKEN WIRES

One of the most common signs of rope deterioration is broken wires, normally the outside wires on the crowns of the strands.

**RUNNING ROPES** Because of their contact with sheaves and drums, running ropes typically receive heavier external wear than standing ropes. This can result in surface wire breaks – the easiest kind

to locate during your inspection. The challenge is to find valley wire breaks. These may occur when ropes are used with small diameter sheaves, sheave grooves that are too small, heavy loads and other poor operating conditions. During your inspection, pay close attention to the areas of the rope in contact with sheaves and drums when loads are picked up. If there is a reason to suspect valley wire breaks, such as a reduction in rope diameter or elongation of rope lay, perform an inspection as outlined below for standing ropes.

**STANDING ROPES** Most wire breaks in standing ropes are internal (or valley) breaks that occur at the points of wire contact. Inspection will reveal no surface wear and therefore nothing to cause external wire breaks. The majority of broken wire problems on standing ropes occur near the end attachments or other points of restriction where vibration is dampened.

### ROPE INSPECTION CRITERIA FOR DRILLING OPERATIONS

All portions of wire rope must be inspected thoroughly for possible deterioration on a regular basis. This starts with a close examination of the rope's critical points. The critical points of an application are those that subject the rope to greater internal stresses or greater external forces. Rope wear is more likely in the following critical areas, so it pays to closely inspect these areas:

**DRUMS** When the rope spools properly, normal wear occurs at the crossover, kickover and change-of-layer points. Look for scrubbing on the side of the rope; in other words, rope that rubs against the preceding wrap on the drum. Crushing may result on rope's top and bottom sides. If severe, remove the rope from service. Both the scrubbing and the crushing normally occur twice with each drum revolution.

Inspection of drums is also critical. Check for signs of wear that could damage wire rope. All drums should be smooth, not corrugated. Check for minimum number of dead wraps remaining on the drum, the spooling characteristics of rope and the condition of flanges.

**SHEAVES** It's very important to check for broken wires in the wire ropes traveling over the sheaves in your system. (See section on broken wires on facing page.)

Grooves tend to wear smaller over time, especially under heavy loading conditions. With a groove gauge, check each

sheave for proper sizes, as well as their smoothness. Grooves that are too small or tight can cause pinching and increased abrasion while grooves that are too wide can cause flattening of the rope – both of which can reduce your rope's life. Also inspect for corrugation, broken or chipped flanges, cracks in hubs and spokes, signs of rope contact with guards, sheave bearings and shaft, an out-of-round condition, and alignment with other sheaves – all criteria for replacement.

**END ATTACHMENTS** Rope adjacent to end attachments has its movement restricted and is subject to fatigue as rope vibrations are dampened. Inspect with an awl to expose broken wires, and if more than one broken wire is found, replace the rope. Be sure to also inspect the fitting itself.

#### OTHER IMPORTANT AREAS TO INSPECT:

**PICK-UP POINTS** The sections of a rope that contact sheaves or drums when the initial load is applied.

**HEAT EXPOSURE** If an electric arc contacts the rope, remove the entire rope from service immediately. Although the problem may not be visible, electric arcs can affect the rope's properties and the rope needs to be replaced.

**ABUSE POINTS** Look for "bright" spots where ropes are subjected to abnormal scuffing and scraping.