General Wire Rope Inspection Reference

The most widely used wire rope replacement, inspection and maintenance standard for mobile-type cranes is ASME B30.5, section 5-2.4. The following is an excerpt from that standard.

All running ropes in service should be visually inspected once each working day. A visual inspection shall consist of observation of all rope which can reasonably be expected to be in use during the day's operations. These visual observations should be concerned with discovering gross damage, such as listed below, which may be an immediate hazard:

- [A] Distortion of the rope such as kinking, crushing, unstranding, birdcaging, main strand displacement, or core protrusion. Loss of rope diameter in a short rope length or unevenness of outer strands should provide evidence that the rope must be replaced.
- [B] General corrosion
- [C] Broken or cut strands
- [D] Number, distribution, and type of visible broken wires
- [E] Core failure in rotation resistant ropes: when such damage is discovered, the rope shall be either removed from service or given an inspection (further detail per S-2.4.2).

The frequency of detailed and thorough inspections should be determined by a qualified person, who takes into account the following factors:

- Expected rope life as determined by [a] maintenance records, and [b] experience on the particular installation or similar installations
- Severity of environment
- Percentage of capacity lifts
- Frequency rates of operation, and exposure to shock loads

Inspect the entire length of the rope. Some areas of the wire rope such as around the core are more difficult to inspect. To inspect the core, examine the rope as it passes over the sheaves. The strands have a tendency to open up slightly which will afford the inspector a better view of the core. Also regularly inspect for any reduction in diameter and lengthening of rope lay as both conditions indicate core damage.

Wire Rope Basic Inspection Guidelines

Abrasion

Abrasion damage may occur when the rope contacts an abrasive medium or simply when it passes over the drum and sheaves. Therefore it is vital that all components be in proper working order and of the appropriate diameter for the rope. A badly corrugated or worn sheave or drum will seriously damage a new rope, resulting in premature rope replacement.

Corrosion

Corrosion is very difficult to evaluate but is a more serious cause of degradation than abrasion. Usually signifying a lack of lubrication, corrosion will often occur internally before there is any visible external evidence on the rope's surface. A slight discoloration caused by rusting usually indicates a need for lubrication which should be tended to immediately. If this condition persists, it will lead to severe corrosion which promotes premature fatigue failures in the wires and strands, necessitating the rope's immediate removal from service.

Wire Breaks

ASME No	Equipment	No. Broken Wires In Running Ropes In		No. Broken WIres In Standing ropes In	
		one rope lay	one strand	one rope lay	one strand
B30.2	Overhead and gantry crane	12	4	na	na
B30.4	Portal, tower, and pillar cranes	6	3	3	2
B30.5	Crawler, locomotive, and truck cranes	6	3	3	2
B30.6	Derricks	6	3	3	2
B30.7	Base-mounted drum hoists	6	3	3	2
B30.8	Floating cranes and derricks	6	3	3	2
A10.4	Personnel hoists	6*	3	2*	2
A10.5	Material hoists	6*	na	na	na

* Also remove for one valley break. OSHA requires monthly record keeping of wire rope conditions. Notes: current industry recommendations and OSHA standards are based upon steel sheaves. The manufacturer of plastic and synthetic sheaves or liners should be consulted for its recommendation on the safe application of the product and inspection criteria. Caution: All dimensions and other information in this web are subject to change without notice. Use for preliminary reference only, and then call before ordering. When dimensions are critical, request a certified print.

The table shows the number of allowable wire breaks per crane type. The inspector must know the ASME standard for the equipment being inspected. The number of broken wires on the outside of the wire rope is an indication of its general condition and whether or not it must be considered for replacement. The inspector may use a type of spike to gently probe the strands for any wire breaks that do not protrude. Check as the rope runs at a slow speed over the sheaves, where crown (surface) wire breaks may be easier to see. Also examine the rope near the end connections. Keeping a detailed inspection record of the wire breaks and other types of damage will help the inspector determine the elapsed time between breaks. Note the area of the breaks and carefully inspect these areas in the future. Replace the rope when the wire breaks reach the total number allowable by ASME or other applicable specifications.

Valley breaks, or breaks in between strands, must be taken very seriously at all times! When two or more valley breaks are found in one lay-length, immediately replace the rope. Valley breaks are difficult to see; however, if you see one you can be assured that there are a few more hidden in the same area. Crown breaks are signs of normal deterioration, but valley breaks indicate an abnormal condition such as fatigue or breakage of other wires such as those in the core.

Once crown and valley breaks appear, their number will steadily and quickly increase as time goes on. The broken wires should be removed as soon as possible by bending the broken ends back and forth with a pair of pliers. In this way the wire is more likely to break inside the rope where the ends will be tucked away. If the broken wires are not removed they may cause further damage.

The inspector must obey the broken wire standard; pushing the rope for more life will create a dangerous situation.

Diameter Reduction

Diameter reduction is a critical deterioration factor and can be caused by:

- Excessive abrasion of the outside wires
- Loss of core diameter/support
- Internal or external corrosion damage
- Inner wire failure
- A lengthening of rope lay

  It is important to check and record a new rope's actual diameter when under normal load conditions. During the life of the rope the inspector should periodically measure the actual diameter of the rope at the same location under equivalent loading conditions. This procedure if followed carefully reveals a common rope characteristic -- after an initial reduction, the overall diameter will stabilize and slowly decrease in diameter during the course of the rope's life. This condition is normal. However, if diameter reduction is isolated to one area or happens quickly, the inspector must immediately determine (and correct, if necessary) the cause of the diameter loss, and schedule the rope for replacement.

Crushing

Crushing or flattening of the strands can be caused by a number of different factors. These problems usually occur on multilayer spooling conditions but can occur by simply using the wrong wire rope construction. Most premature crushing and/or flattening conditions occur because of improper installation of the wire rope. In many cases failure to obtain a very tight first layer (the foundation) will cause loose or "gappy" conditions in the wire rope which will cause rapid deterioration. Failure to properly break-in the new rope, or worse, to have no break-in procedure at all, will cause similar poor spooling conditions. Therefore, it is imperative that the inspector knows how to inspect the wire rope as well as how that rope was installed.

Shockloading

Shockloading (birdcaging) of the rope is another reason for replacement of the rope. Shockloading is caused by the sudden release of tension on the wire rope and its resultant rebound from being overloaded. The damage that occurs can never be corrected and the rope must be replaced.

High Stranding

High stranding may occur for a number of reasons such as failure to properly seize the rope prior to installation or maintain seizing during wedge socket installation. Sometimes wavy rope occurs due to kinks or a very tight grooving problem. Another possibility is simply introducing torque or twist into a new rope during poor installation procedures. This condition requires the inspector to evaluate the continued use of the rope or increase the frequency of inspection.