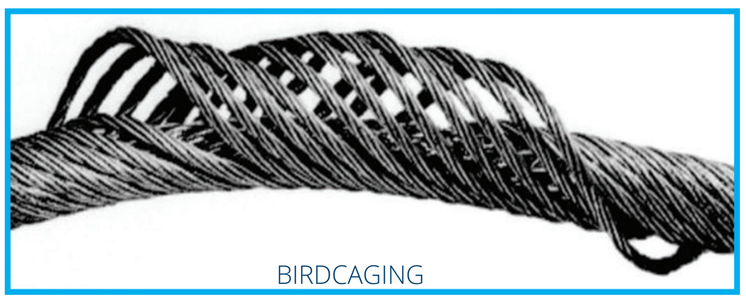
COOKES

a BRIDON · BEKAERT Ropes Group Brand

INSPECTION OF WIRE ROPE



BIRDCAGING

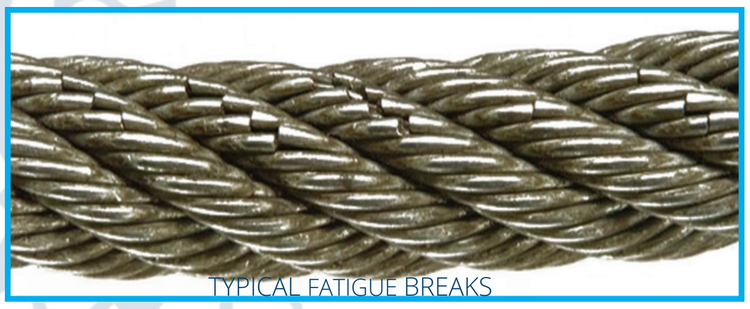
INTERNAL CORROSION

CORE KNUCKLE

MECHANICAL DAMAGE

ARC DAMAGE

EXTERNAL WEAR



TYPICAL FATIGUE BREAKS

INTRODUCTION

The most important aspect of operating a rope safely is properly performed inspection, done on a regular basis. BS ISO 4309:2017 provides detailed inspection procedures and retirement criteria. The standard also covers all in service running ropes where regular visual inspections are required that consist of observation of all rope that can reasonably be expected to be in use during operations on that day. The inspection must be more than just a quick look. It needs to be done carefully and, in enough light, to find damage or broken wires that may require the rope to be taken out of service. It must also be remembered that a dirty or greasy rope is almost impossible to inspect properly, as dirt and grease may hide problem areas. The individual making the inspection should be familiar with the machine, the wire rope, and that particular application. The BS ISO 4309:2017 provides information on both frequent inspections to be done and much more detailed periodic inspections that are done that can be on a weekly or monthly basis dependent on site specific application.

FREQUENT INSPECTION

As stated previously, all running ropes in service should be visually inspected regularly and shall consist of observation of all rope that can reasonably be expected to be in use during operations on that day. The inspector should know where and how rope on the particular application wears out so that the daily inspection can be focused on the known wear areas.

(1) Flange step up, cross over points and repetitive pick up on the drum
(2) Areas of the rope operating through a reverse bend in the reeving system
(3) Equalizer sheaves
(4) End terminations

Note: The inspector should be concerned with discovering gross damage that may be an immediate hazard.

(1) Distortion to the uniform structure of the rope
(2) Broken wires
(3) Corrosion
(4) Gross damage to or deterioration of end connections
(5) Evidence of heat/electrical/lightning damage
(6) Localized change in lubrication condition

When damage is discovered, a qualified person must evaluate affected sections as detailed in the rope replacement section below to determine if the rope needs to be removed from service. Also, when doing regular in-service inspections, it is a good idea to keep a frequent inspection log on the crane, simply noting time, date, identity of the inspector and any obvious findings.

PERIODIC INSPECTION

The inspection frequency needs to be based on factors such as expected rope life as determined by experience on the particular installation or similar installations, severity of environment, percentage of capacity lifts, frequency rates of operation, and exposure to shock loads. Standard periodic inspections as outlined in the Standards and Approved Code of Practice should be at intervals not exceeding 12 months. Inspections need not be at equal calendar intervals and should be more frequent as the rope approaches the end of its useful life. There are many duty cycle rope applications where the service life is less than a month, or sometimes even a week in severe service conditions, so a periodic level of inspection may have to be performed daily.

The periodic inspection must cover the surface of the entire rope length and no attempt should be made to open the rope. In addition to common repetitive wear sections checked during the frequent inspection, additional sections prone to rapid deterioration such as the following need special attention:

(1) Locations where rope vibrations are damped, such as the following:
(a) Sections in contact with equalizer sheaves.
(b) Sections of the rope at or near end connections where corroded or broken wires may protrude
(2) Bridle reeving in the boom hoist ropes
(3) Repetitive pickup points and crossover and change of layer points at flanges on drums
(4) Fleeting or deflector sheaves

In addition to the specific types of damage listed in the frequent inspection section, these additional items need to be addressed:

(1) Measuring the rope diameter in numerous locations to assess uniform loss of diameter along the entire length of rope
(2) Close visual observation of the entire length to identify:
(a) Diameter reduction in localized areas
(b) Steel core protrusion between the outer strands
(c) Wear of outside wires
(d) Severely corroded, cracked, bent, worn or improperly applied end connections of rope
(e) High or low strand
(f) Lengthening of lay in localized areas
(g) Distortion of rope structure (kinking, bird caging, crushing)
(h) Internal corrosion
(i) Detailed inspection of end connections for damage
(j) Waviness (corkscrew effect)

To establish data as a basis for judging the proper time for replacement, a dated report of rope condition at each periodic inspection must be kept on file. This report shall cover points of deterioration listed above. If the rope is replaced, only the fact that the rope was replaced need be recorded. Certain types of ropes and applications require special attention and require reduced time intervals between periodic inspections:

- Rotation Resistant ropes have a unique construction and are susceptible to damage and increased deterioration when working under difficult conditions such as duty cycle operations.
- Boom hoist ropes because of the importance of their function and because their location may make inspection difficult.

ROPE REPLACEMENT

There are no precise rules to determine the exact time for the replacement of the rope since many variable factors are involved. Once a rope reaches any one of the removal criteria, it must be replaced in accordance with the instruction and guidelines outlined by the competent person carrying out the inspection. As a general rule - attributes and removal criteria are:

(1) Broken wires:
(a) For common ropes operating on equipment covered by the standards and Approved Codes of Practice, in running ropes, 6 randomly distributed wire breaks per rope lay or 3 wire breaks per strand per rope lay. A rope lay is the distance that it takes one outer strand to make one complete revolution around the rope. A 6-strand rope will typically have a rope lay of 6.4 times the rope diameter.
(b) For all categories of Rotation Resistant (Non-Spin) ropes, the retirement criteria is 2 wire breaks in 6 rope diameters or 4 wire breaks on 30 rope diameters (i.e. 6 rope diameters in a 1" rope is 6")
(c) One broken outer wire at the contact point with the core which has worked its way out of the rope structure and protrudes, loops out or is slightly raised from the body of the rope.

Note: Due to the difficulty in detecting wire breaks when polymer are utilized with single layer drums, the user should contact the sheave manufacturer for broken wire removal criteria.

(2) Reductions from nominal diameters greater than 10% as a norm, of the original rope diameter
(3) Distortion of rope structure:
(a) Damage resulting in distortion of the rope structure (e.g., kinking, bird caging, crushing)
(b) Steel core protrusion between the outer strands
(c) Localized change in lay length
(d) Changes in original geometry due to crushing forces where the diameter across the distorted section is 5/6 of the nominal diameter.

(4) Waviness (corkscrew effect) in the rope that causes overall diameter to increase to a value greater than 110% of nominal rope diameter.
(5) A high or low strand that is higher or lower than ½ of the strand diameter above or below the surface of the rope.
(6) Any apparent damage from a heat source including, but not limited to welding, power line strikes, or lightning.
(7) Widespread or localized external corrosion as evidenced by pitting, and obvious signs of internal corrosion such as magnetic debris coming from valleys.
(8) Severely corroded, cracked, bent, worn, grossly damaged, or improperly installed end connections

ROPE SERVICE LIFE

A long-range inspection program should be established and should include records on the examination of ropes removed from service so that a relationship can be established between visual observation and actual condition of the internal structure. There are a wide variety of wire rope constructions available to be used on cranes. It is important that the correct rope be used for each specific application. Because wire rope wears in service, the method by which the rope wears is an important factor in determining the most suitable rope. Replacement rope must have a rated strength at least equal to the original rope supplied or recommended for the machine. Any change from the original specification for the rope must be specified by the wire rope manufacturer, crane manufacturer, or qualified person.

When there is a question, consult with Cookes about the rope construction most appropriate for the application

NATIONAL SERVICE | 11 LOCATIONS THROUGHOUT NEW ZEALAND 0508 274 366 CUSTOMERSERVICES@COOKES.CO.NZ WWW.COOKES.CO.NZ