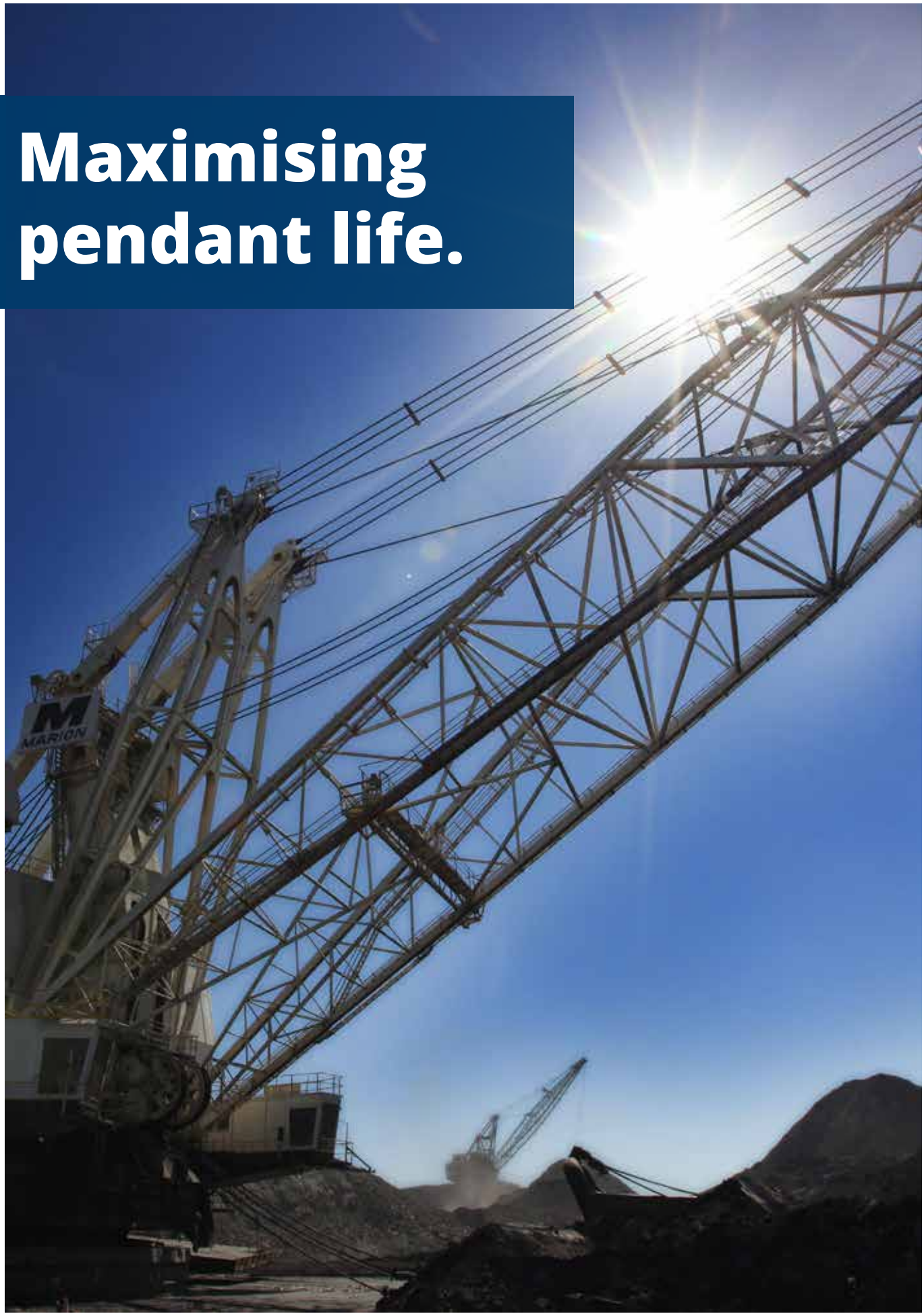
WRI
a BRIDON · BEKAERT Ropes Group Brand

Maximising pendant life.

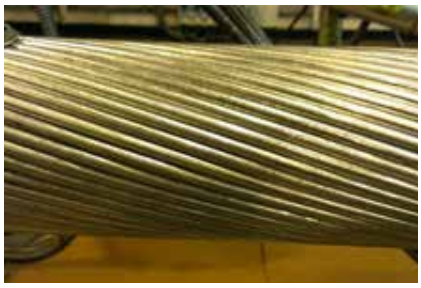


MAXIMISING DRAGLINE SUSPENSION ROPE LIFE

Spiral strand

To maximise the life of dragline suspension pendants, it is important to understand the pendant manufacturing process and the mechanisms leading to the ultimate failure mode. Suspension pendants are made using a spiral strand product. The strand consists of layers of galvanised high tensile steel wire wound in alternating directions. The end termination is a cast steel socket. To join the wire to the socket, the wires in the strand are spread and molten zinc poured into the socket bowl to form a conical block to secure the strand.

Spiral Strand Cross section



Spiral Strand

Final socket after pouring molten Zinc

Strand wires are spread and cleaned prior to socketing

Failure mode

The typical failure mode of dragline pendants is fatigue wire breaks within one metre of the base of the socket. The wire breaks occur due to heavy nicking between the alternating wire layers caused by repeated bending of the strand over an extended period. Often this area becomes devoid of lubricant and corrosion may result.

The fatigue is accelerated when the socket connection to dragline pin joint is not free to move.

Heavy nicking of wires in second layer in from a failed pendant.

Heavy nicking, poor lubrication,corrosion from failed pendant

How to Extend Pendant life.

Lubricate the Pin Connection

The movement of the dragline boom causes the suspension pendants to oscillate. The pendants are joined to the dragline using a pin connection. It is important that this pin connection is free to move, otherwise the bending will be transferred to the strand at the base of the socket. Bridon-Bekaert Australia supplies pins with lubrication grooves and a grease port to assist in lubricating this connection point. It is recommended dragline pendants are observed during operation to confirm the socket connection is free to move.

Lubrication grooves in pin

Lubrication port

This is the single most important thing you can do!

Lubricate the Strand through the Lubrication Tube

Even when the pin connection is free to move, some bending will occur at the base of the socket. It is recommended that lubricant is applied through the lubricant tube periodically to reduce the friction between the wire layers and subsequent nicking. Bridon-Bekaert Australia recommends a lithium soap grease with EP additives 4 times per year x 50 gm (until grease is seen to exit the surface of the strand).

Lubrication Tag

Lubrication system on a Dragline

Auto Lubrication system feeding

Alternate method of pin lubrication

Use Socket Dampers

Dampers bolt on to flanged sockets and extend the support point further out along the strand. This moves the fatigue point from the base of the socket to the end of the damper. The dampers are removed mid-life and the fatigue point shifts to the base of the socket.

Although the use of dampers is relatively common in the mining industry, their effectiveness to improve pendant life is not guaranteed. It is recommended that a thorough review of the maintenance process and costs is conducted when considering the use of dampers

Damper

Quality

The strand should comply with the relevant OEM and Australian standard. All the wires in the strand should be tested to a relevant standard and test certificates be available. The wire should have a heavy class of galvanising and the strand be fully lubricated. The sockets should comply with OEM specifications and be manufactured by an accredited socket supplier. The socketing should comply with AS2759 and relevant OEM standards.

Pendant Size Upgrade

An emerging trend is to increase the size of the strand in response to the increased RSL's. Bridon Bekaert can supply upgraded strength pendants that assist in managing the increased RSL's.

Inspection & Testing

To monitor the condition of the pendant, an inspection regime must be established. Historically, the inspection methods and frequency have been determined based on the model of the machine and through implementing risk based inspection (RBI) methodologies in agreement between the operator, OEM and testing authority. The inspection regime should consist of routine Visual Inspection and Non-Destructive Testing (NDT).

Visual Inspection

The pendants are inspected visually, typically during a 3 or 4 weekly maintenance outage. Signs of corrosion in the strand at the base of the socket are an indication of heavy internal fretting. This is a result of lack of lubrication and excessive bending in the strand. It is recommended to manually lubricate the strand through the lubrication tube until grease comes out of the strand. It is also recommended to check the socket pin connection is free to move and has sufficient lubrication.

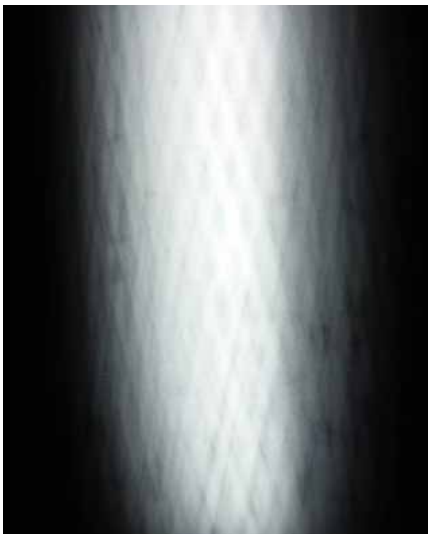
Signs of waviness in the strand usually indicate internal failure of the strand. If the core of the product fails it will not support the outer layers and cause the strand to appear wavy. It is recommended to change the pendants as soon as possible if this occurs.

The number of external broken wires should be recorded and tracked

Non-Destructive Testing (NDT)

In addition to the Visual Inspection, the pendants are tested to determine any fatigue of the internal wires using a recognised Non-Destructive Testing (NDT) Technique, such as Gamma-Ray Radiographic Testing (RT).

This method produces a radiograph, which can then be viewed to determine the number of internal wire breaks in the tested area. The frequency for NDT will change dependent on the condition, type and/or age of the pendant and is usually on a 6 monthly or annual frequency. Although RT does have limitations, including loss of definition on larger diameter strands, it is the most common NDT technique for the detection of internal broken wires in dragline suspension ropes.



Sample Pendant Radiograph

When do pendants need to be replaced?

NDT companies will provide reports indicating the percentage of wire breaks of a pendant. Typically, the NDT process will identify less wire breaks than are actually present. Our experience has indicated that you will need to multiply the number of reported wire breaks by a factor 2.5 to provide a number that reflects the actual number of wire breaks. The industry standard is to replace a pendant when the reported number of wire breaks exceeds 10% of the total number of wires in the strand.

Managing deteriorating pendants

Bridon-Bekaert Australia holds stock of all sizes of strand and an extensive range of new and refurbished sockets. For a planned maintenance period, a customer should plan on a 10 week lead time for delivery of new pendants to a site. For “emergency” situations, WRI Australia has supplied sets of pendants within 7 working days. Bridon-Bekaert Australia’s aim is to keep pendant supply off the mines critical path when repairing a dragline or shovel.

SPIRAL STRAND BREAKING STRENGTH

Spiral Strand					
Diameter (mm)	Construction	Min Breaking Force (kN)	Nominal mass (kg/100,m)	Nominal Area (mm2)	Young Modulus Gpa
36	1x61	1150	687	789	166
40	1x61	1420	848	975	166
44	1x61	1710	1050	1200	166
48	1x91	2050	1260	1450	166
52	1x91	2400	1480	1700	166
54	1x91	2610	1610	1850	166
58	1x127	2850	1760	2020	158
64	1x127	3640	2250	2580	158
70	1x169	4450	2750	3150	158
76	1x169	4850	2990	3430	158
82	1x217	5560	3520	4050	158
86	1x217	6040	3830	4400	158
90	1x217	6940	4400	5050	158
95	1x217	7550	4790	5500	158
102	1x217	8850	5610	6440	158

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