

THE RIGHT CONNECTION

Paul Badeau, Applied Fiber, USA, examines the advantages of utilising fibre pendants as a connection point technology, and how they can be used as an effective alternative to steel wire.

Figure 1. Shock damping fibre pendants on electric rope shovel.



The connection point is critical to maintaining safety when using high performance steel cables. Shackles, masterlinks, hooks, and poured and wedge sockets have long been used on mine sites to make the tension connection for all kinds of applications, and work very well with steel wire ropes, rods, or chains.

Fibre rope has numerous benefits for utilisation, but is held back because the methods to terminate or connect have been limited to a knot or splice as the only options. While this works in many applications, the termination method is not suited for long term use and is not robust enough to handle the rough mining environment, as the connection is susceptible

to early wear, outside contamination, and inspection and retirement issues are long standing.

Why change?

Performance fibres are used in large rope applications and have many advantages over steel. Examples include: reduced weight, non-corrosive, ultra-low-conductivity, easier and safer handling, higher efficiency in task-oriented jobs, no grease or lubrication needed, increased damping and reduction in impact loads, and a lower environmental footprint among others.

Gaining these advantages are substantial if the drawbacks on termination can be addressed – particularly for large ropes used in heavy industries.

Socketing fibre is a challenge, as unlike wire ropes that have thick wire strands for which sockets can be easily poured, fibre filaments are the thickness of a human hair. It takes millions of these filaments to make up a high strength rope. Pouring sockets in the traditional manner using fibre does not work, the fibres are loose and fall over, tangle and become misaligned, resulting in inconsistency and unreliability. Break strengths are greatly reduced and there is no assurance on outcome.

Assured socketing performance opening new fibre rope markets

Applied Fiber technologies address these issues relating to connection and allow utilisation of the performance benefits of fibre. Through integration of Applied Fiber's proven fibre socketing technology with a robust termination, the final product is a highly efficient and repeatable performing rope assembly. This technology has opened up new applications for fibre rope adoption.

It is most widely known on coal mines that draglines are the work horse to remove overburden and are critical to its success. Dragline boom pendants require a robust termination and precise pendant lengths for proper long-term use,

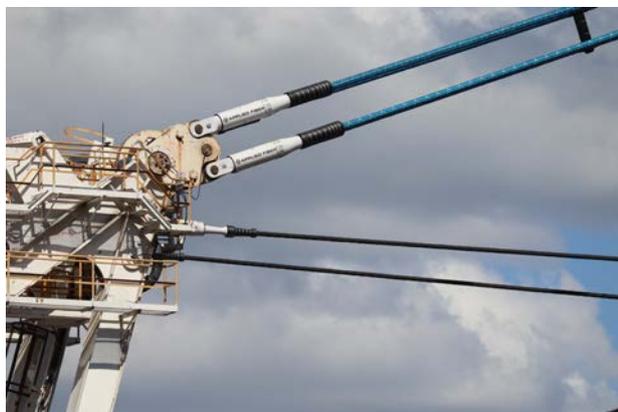


Figure 2. Applied Fiber Bridon Tiger Blue Pendants – showing main and intermediate boom support pendants connecting at tri structure on dragline.

in order to balance the tensions on the boom and loads properly. If fibre could be utilised instead of steel wire between the sockets, a number of benefits could be realised. A practical and efficient termination or socket did not exist for synthetic ropes until Applied Fiber developed the technology to repeatedly process sockets with predictable performance criteria, delivering both pendants that are perfectly matched in length with an end fitting that can handle high fatigue loading cycles that a dragline endures over numbers of years.

The first synthetic pendants were reported on in *World Coal* seven years ago. The fibre pendants installed on a Marion 8200 are still going strong and have outlasted the normal life of steel.

The first dragline installed fibre main pendants were in 2016 in Wyoming, US. It was noted during its seventh annual inspection that the pendants have been performing even better than anticipated. Where some steel pendants are changed out as soon as every five or six years, the pendants on the Marion 8200 at Navajo Transitional Energy (NTEC) appear “just broken in”, and that they will also exceed double the life of the steel with numerous additional benefits. This additionally will allow for extension of the time between boom laydowns, as they will not have to be replaced as soon, which will result in both maintenance savings and a production boost.

The first-installed set of cables have seen over 1350 machine cycles daily, which equates to millions of fatigue cycles and over 200 million micro-bending and tension cycles in this time. The pendants provide the machine, operator, and production a number of benefits.

Pendants at NTEC

The Applied Fiber pendants are a big step for change in dragline technology. NTEC converted the Marion 8229 in 2016, the 8233 in 2017, and a BE1570 lot 12 in 2018 – all of which have significantly smoothed out the machine operation.

On the first 8200, key 29, the bucket capacity was effectively increased to 2 yd³ (due to increased soil density) and only limited operating issues have been reported in six years – a noteworthy change from prior years with steel pendants. The pendants have made a huge difference; the machine swings well and has noticeably less bouncing and vibration.

The second 8200 that the pendant was installed on was getting beat up, so the steel was replaced two years early and the payload was increased by 5 yd³ (from 82 to 87 yd³). Since installing the pendants on this machine four years ago, the machine now operates much more smoothly, due to the lack of pendant bouncing and overall system damping.

On the 1570, the machine is also running much smoother, with significantly less fatigue. Before, regular cracks would typically be seen in boom nodules 8, 10 and 14, creating one to two weeks of

downtime a year. Since installing fibre pendants years ago, there has only been minor cracking in this region. It is estimated that several weeks of production in the years of operation with the fiber pendants has been gained.

Visitors can see the difference from a distance and the operators appreciate how much it quiets the machine movement. One operator went from having numb hands at the end of a shift to having no issues, outlining that the difference both in the cab and outside the machine is very noticeable. So, putting a low-mass dampener into the boom can make all the difference.

More production, less wear and tear, less downtime, and much smoother operation – NTEC was pleased with what the pendants have done for its draglines. It was forecasted just under a two-year ROI and actual performance has met and in many cases exceeded predictions.

Since the first installment, several draglines in the US and in Australia have been upgraded to fibre pendants. All of these pendants are expected to surpass the life of steel and gain the additional benefits that NTEC achieved.

Conclusion

The product, now installed on draglines globally for both main and IBS pendants, is running on electric rope shovels. The product is providing benefits to both



Figure 3. Bridon Tiger Blue Applied Fiber pendants on an Australian shovel.

production and maintenance, as the multiple benefits of fibre are delivering weight savings and lowering the burden on the equipment.

Electric rope shovels are benefiting from fibre in ways that were not previously expected. Reduced shock loads when the boom jacks and dampened vibration are in operation are proving to be a valuable maintenance benefit of fibre rope pendants on shovels, reducing welding. The 4100 Shovels are outfitted with fibre pendants, and are benefitting from these improvements during operation. 

On-Belt Real Time Coal Analysers

Saving you coal blending, sorting and monitoring headaches!

- **Ash, Specific Energy, Sulphur**
- **Moisture**
- **Over 1,000 installations worldwide**
- **Accurate and reliable results**
- **Low maintenance, remote support**
- **Serviced by local engineers**
- **Guaranteed performance**



Making your process control easy



+61 7 3710 8400
sales@scantech.com.au
www.scantech.com.au

